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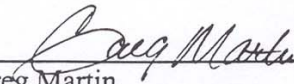
Requirements and Architecture:
A Strategy for Evolving the FAA's Web Presence
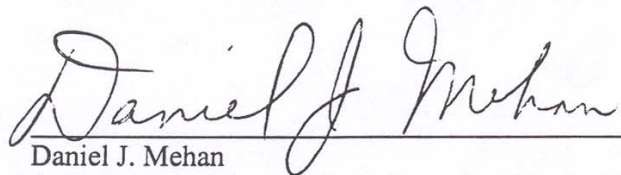
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Prepared by the:
Information Management Division
Office of the Assistant Administrator for Information Services
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FAA Requirements and Architecture:
A Strategy for Evolving the FAA's Web Presence

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Table of Contents

Table of Figures

Table of Tables

Executive Summary

The purpose of this document is to frame requirements and actions for developing a more strategic Web-based presence. This document was initiated as a result of the participation of the Office of the Assistant Administrator for Information Services and Chief Information Officer (AIO) and the Office of the Assistant Administrator for Public Affairs (APA) on the Web Policy Council. Its purpose is to aid APA, Federal Aviation Administration (FAA) management, the Web Policy Council, and the Chief Information Officer Council in acting upon the challenges of managing the FAA's Web environment.

While the FAA has made a number of improvements to its Web presence over the past year, including a new home page and design standards, the current FAA external Web environment is the result of a bottom-up approach using a variety of navigation, layout, content, and branding approaches. A recent usability test indicated a variety of difficulties that users reported. A Giga assessment of five Department of Transportation Web sites in September 2001 reported positive and negative attributes of the FAA Web site.

At the same time, the Agency faces *a number of business changes and drivers* that will impact its Web site and Web capabilities. The challenges have been detailed in the FAA's Information Technology (IT) Strategy, its E–Government Strategy, and other related documents. The FAA's current strategies indicate that meeting these challenges effectively will require a significantly expanded use of the Web to deliver information and services to FAA constituents and employees. These strategies should be consistent with best practices in the private and public sector, where organizations are "moving work to the Web" in order to improve performance and decrease operating costs.

Developing *more robust agencywide Web capabilities* requires a fundamentally different *concept of operations* for doing business on the Internet. To date, the FAA's current concept of operations has been sufficient for delivering moderate volumes of content and Web-based transactions. However, its current concept of operation – which is highly decentralized, lightly standardized, using a bottom-up approach – will become increasingly complex, expensive, and failure-prone as the FAA demands more value from its Web resources.

Before becoming a fully Web-enabled agency, the FAA needs to shift to a *transitional* concept of operation. Best practices and the E-Government provisions of the President's Management Agenda point toward a model of operation that might be called "the Web-enabled agency." In this model, the Internet is a key method for delivering a full range of information, content, and services across the enterprise to customers and stakeholders, and Web resources are rigorously managed as strategic IT assets.

This is a significant shift and, due to the scope of change required, the FAA should employ a transitional rather than direct approach to achieve the change. A *transitional* concept of operations:

- Delivers significant support for agency business objectives.
- Provides for a more effective and efficient management of current Web resources.
- Lays the foundation for building a world class Web capability.

A move toward *a transitional concept of operations generates new requirements* for how the FAA delivers content and services via the Web, for the technology that supports delivery, and for how the organization manages its Web operations. These requirements clearly illustrate the changes necessary to move from the FAA's current concept of operations to a transitional concept of operations and emphasize that building better Internet capabilities is not only a matter of "redesigning the Web site," but rather one of significant organizational and technological shift.

The FAA should act now to begin the transition. While the shift from a "having a Web site" to "moving work to the Web" requires a significant effort, it is a road that many organizations have traveled and the challenges are manageable. This document recommends specific actions to get the FAA started:

- Develop a business case and roadmap for developing FAA Internet resources.
- Establish a *"federated" Web governance structure* that defines how agency lines of business and staff organizations share ownership of agency Web resources.
- Develop *enforceable processes and policies* for agency Web operations and security.
- Establish an FAA-wide *Public Key Infrastructure capability* for issuing, managing, and processing digital certificates.
- Define *performance metrics* for the Internet content and service delivery.
- Implement *enterprise content management* and *consolidate Web resources* into federated centers.

Chapter 1   Introduction

    1.1   Purpose and Scope

The purpose of this document is to provide a basis for agency consensus on a strategic direction for the Federal Aviation Administration's (FAA) external Web presence. This strategy was initiated as a result of the participation of the Office of the Assistant Administrator for Information Services and Chief Information Officer (AIO) and the Office of the Assistant Administrator for Public Affairs (APA) on the Web Policy Council. AIO developed this strategy in an advisory capacity to aid APA, FAA management, the Web Policy Council, and the Chief Information Officer Council in meeting the challenges of planning and managing the FAA's evolving Web environment. The scope of this document is the FAA external Web presence or Internet.

    1.2   Background

The study builds on past FAA Web improvement initiatives[1]. On October 1, 2002, the agency placed responsibility for the FAA Web environment with the APA via Notice 1370.40. This notice is currently being implemented.

    1.3   Business Drivers

The FAA's business and information technology (IT) objectives require more robust Internet capabilities. While the FAA has made a number of improvements to its Web presence over the past two years, the agency faces a number of business changes and drivers that will impact its Web site and Web capabilities. There is an ongoing need to provide strategic management to the FAA's Internet presence. These drivers are listed below and shown in Figure 1; more detail is provided in Appendix A.

      1.3.1   External Drivers:

- Citizen Expectations.
- Partner Demands.
- Technology Advances.
- President's Management Agenda (PMA) and Electronic Government (E-Government).
- Regulatory and Statutory Requirements – These include but are not limited to the E-Government Act of 2002, the Electronic Freedom of Information Act (e-FOIA), Section 508 of the Rehabilitation Act 0f 1973 (as amended), Information Quality Guidelines (OMB Section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001), Government Paperwork Elimination Act (GPEA), Records Management, Privacy Act, and general Office of Management and Budget (OMB) privacy guidelines.

      1.3.2   Internal Drivers:

- IT Security.
- Constrained Budgets.
- Aging Workforce.
- Infrastructure Modernization – National Airspace System (NAS) and Administrative Systems.
- Evolving Web Governance Practices.
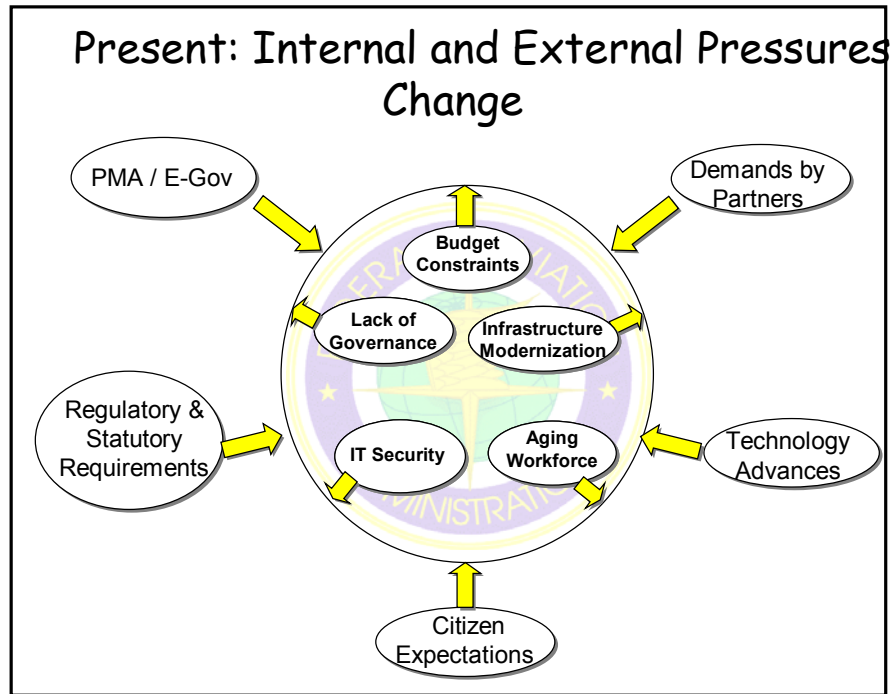
Figure 1- Internal and External Business Drivers

The FAA's IT Strategy has three goals that respond to these drivers as well. Each of the three goals can be linked to this document:

- The Cyber-Security goal is addressed in the requirements sections, particularly technology requirements and architecture.
- The E-Government goal calls for continued improvement of service delivery capabilities and development of project portfolios aimed at the key customer groups of citizens, businesses, other government agencies, and employees, as well as projects dedicated to improving internal efficiency and effectiveness. This strategy for the FAA Web presence reflects this concept of continued improvement.
- The Business Value goal calls for selecting the right IT investments, managing them for maximum contribution to agency goals, managing large cost and performance drivers, and developing and using an enterprise architecture. This strategy calls for business cases to drive Web investments, the gradual adoption of new technologies, and the use of the enterprise architecture as a source of target capabilities to be developed.

The current proliferation of Web sites and resources across the FAA is not conducive to meeting the business requirements of the above drivers, especially the need to provide sufficient system security across all Web servers and capabilities[2]. As the FAA moves forward to improve its Web presence, it faces challenges to consistently address a number of crosscutting initiatives and emerging developments. These are depicted in Figure 2. This diagram indicates that any one of these crosscutting initiatives needs to be implemented by each involved Web steward organization, from our home page down to the lowest page of our Web presence.

Development & Maintenance
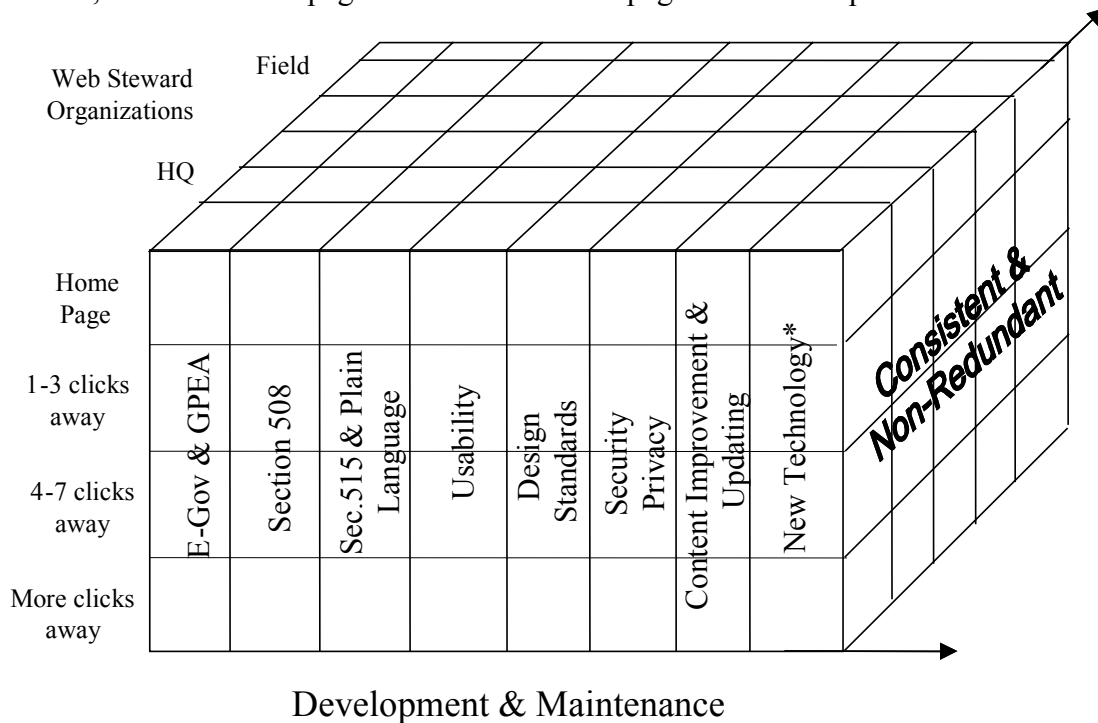
* Web services, content management system, portal design, etc.

Figure 2 - Challenges Facing Federal Web Sites

    1.4   Appendices

Research to develop this strategy included the following:
- The current FAA Internet environment was examined and is characterized in Appendix A.
- Industry best practices are selectively described in Appendix B.
- Observations relating to the FAA Intranet are contained in Appendix C.
- Architecture concepts from industry and government are in Appendix D.
- Definitions of selected terms are in Appendix E.

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[2] Includes substantial requirements that systems have an individual Security Certification and Authorization Package and, once developed, comply with its requirements.

Chapter 2   Concept of Operations

In order to be able to deliver more robust Internet capabilities, the FAA needs to move to a different ***concept of operations*** in its external Web presence.   In this document, concept of operations is a total approach for delivering valuable content and services over the Web, supported by appropriate technologies and by the necessary management processes and policies.

Commercial "best practice" organizations are moving to a concept of operations that permits not only large-scale content delivery, but also sophisticated forms of transactions, data exchange, and collaboration. Figure 3 presents a Web Maturity Model that describes transitioning stages leading to a Web-enabled FAA.
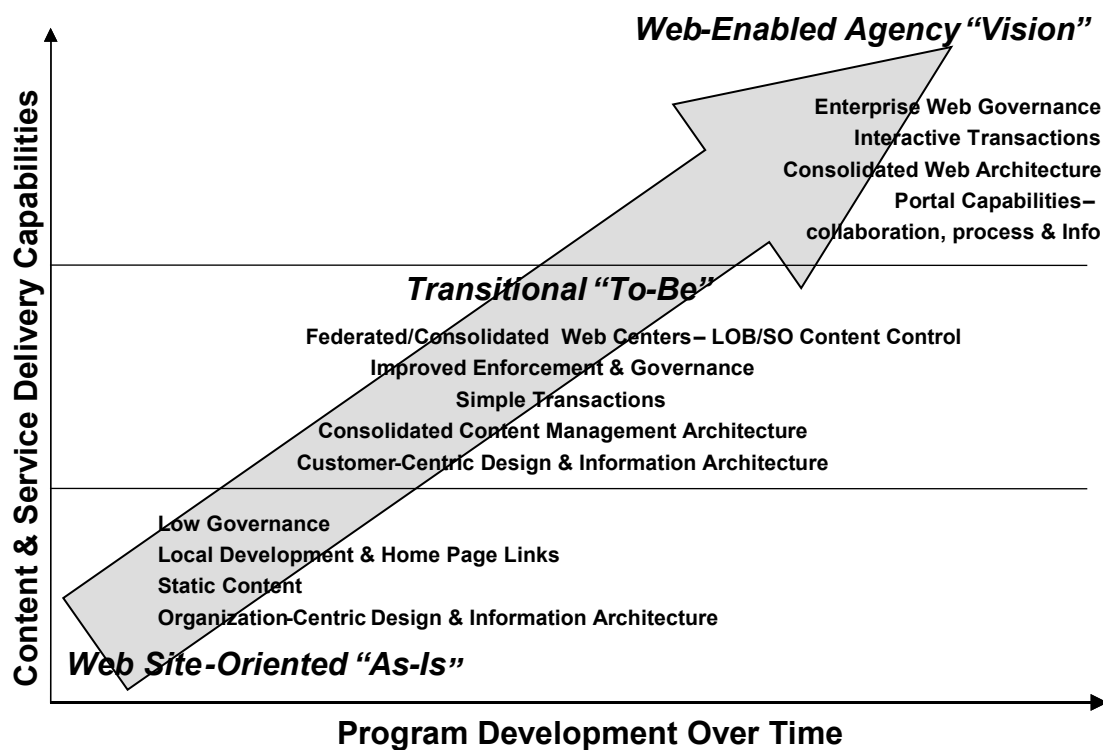
Figure 3 - Web Maturity Model of Organizations: Transitioning

Like most Federal agencies, the FAA's Web resources are now used by each line of business (LOB) and staff office (SO) to provide mostly static content to a variety of external constituents. Its Web technology assets are highly decentralized, as are its governance and management structures for operating on the Internet. As long as the FAA's business goals do not demand more of its Web resources, this *Web site* concept of operations is satisfactory. However, the FAA's *current strategies will demand more robust Internet capabilities and more rigorous management of Internet resources*. This fact creates three challenges:

- First, merely "redesigning the Web site" will not make the FAA more effective at delivering content and services on the Web, just as painting a car will not make it faster or more fuel-efficient.
- Second, if the FAA enables each LOB and SO with the resources necessary to deliver better, more secure content and services on the Web, its cost of operations will skyrocket.
- And, third, if the FAA applies the rigorous, centralized management and security processes required for "best practice" content and service delivery – without making changes to other elements of its Web resource management - the LOBs and SOs will resist changes. There is a need to balance restrictive policies with clear benefits.

Building better FAA Web resource management requires a shift in the FAA's concept of operations for the Web: the content and services it delivers, the technology architecture it develops, and the processes and policies it uses to manage Web resources. Best practices, the Federal E-Government agenda, and the FAA's own strategies point toward the FAA becoming a truly *Web-enabled agency* over the next few years. However, becoming a Web-enabled agency is a significant shift, and the FAA should not attempt to get there directly, but rather, should move now to a transitional concept of operations that addresses its current business objectives and lays the groundwork for becoming a fully Web-enabled agency.

Prototyping of services to demonstrate how new technological capabilities can more effectively create, manage, and publish content, as well as aid the governance process, may include:

- Services geared toward creating and improving FAA's citizen and business entry portals, such as focusing on the distribution of information for the Centennial of Flight, search engine improvements, and job recruitment.
- Services geared toward creating and improving the employee portal, such as enterprise information and knowledge management and the investigation of single sign-on security measures.

The balance of this document defines the requirements generated by a transitional concept of operations for doing business on the Web. Figure 4 describes the organization of the remainder of this document:

CHAPTER	DESCRIPTION
2: Concept of Operations	Supporting FAA business objectives with a more strategic model for Internet resources and management; a target set of capabilities for the near future and long term
3: Guiding Principles	Principles that shaped the requirements
4 through 6: Requirements	Content & service, technology and architecture, and management requirements to support a transitional concept of operations
7: Recommendations	Taking action towards developing better internet resources
Appendices	Background and detail to support the previous Chapters

Figure 4 - Document Organization

2.1 Near Term *Transitional* Concept of Operations

A *transitional* concept of operations is fundamentally different than a *Web site- oriented* concept of operations. Figure 5 describes the transition from today's FAA state, a state focused on Web site management, to a transitional or foundational state.

Concept of Operations

From the "Web site " concept …   … to a transitional concept

Local governance	Federated Governance
Low business value	High business value
Low standards for Web access	High standards for Web access
"Anything goes " Web design	Consistent design and branding
Focus on content producer	Focus on content user
"Webmaster " publishing model	Content management model
Most content is "static"	Blend of content and services
Local Web resources	Consolidated Web resources

Figure 5 - A Transitional Concept of Operations

A federated model is driven by the need to contain costs and ensure security and is made possible by the development of a Web architecture that enables each portion of the organization to publish content to a central Web resource.

The federated approach to managing the agency's Web presence fosters the consistent use of usability and design standards, as well as ensures compliance with regulatory and statutory requirements. A federated model facilitates, or even enables, improved IT security and provides significant savings from economies of scale, including fewer Web servers, administrators, developers and designers, and Web pages. (The proposed federated architecture is further described in the Chapter 5, Technology Requirements and Architecture.)

A federated model will allow the consolidation of resources that support the FAA Web presence, including Web servers and server administrators. In a federated model, regional Web centers provide the infrastructure and technical support needed for the FAA's Web presence, while the LOBs and SOs continue to have control over the content they develop and publish. Some regulatory requirements are executed by the Web centers as a service to LOBs and SOs needing

additional Web support (e.g., privacy notices, many aspects of Section 508 compliance, and some security requirements, such as security certification of Web servers).

A federated Web environment requires an enterprise content management system (CMS) to coordinate FAA delivery, content, and services on the Web. A CMS provides each publishing organization (LOBs and SOs) with a content management console that allows them to publish content to specified locations on the FAA Internet. Local organizations retain their current autonomy over content, but the agency (i.e., the enterprise) gains control over the technology resources required to operate the Web, including ensuring more effective Web management through FAA Web standards.

A *transitional* model of operations brings a fundamental change in the process for access to the agency Web presence. In the current Web site oriented model, local organizations maintain their own Web resources and request permission from the Web Policy Council to link off the FAA home page. *In the transitional model, access to and use of the agency Web presence is governed by enforced standards,* including:

- Business purpose: content and services with a valid business purpose.
- Content quality and "freshness."
- Design quality: consistent look and feel, high usability.
- Compliance with access and security policies and standards including Public Key Infrastructure (PKI).

Organizational authority to publish external Web sites and pages should be limited to those organizations willing and able to meet these responsibilities. Through use of this model, the FAA is likely to reduce the number of organizations with authority to post Web pages. It is also likely to reduce the number of Web pages.

In a transitional model of operations, the FAA would attain more consistent compliance with existing regulatory requirements affecting its external Web presence. Concurrently, the FAA would pursue incremental opportunities for content improvement, GPEA transactions, improved search capabilities, and related business priorities, including support of the Centennial of Flight (December 17, 2003). During this transitional period, any use of Personal Digital Assistants (PDAs) by FAA employees will be focused on communications capabilities (e.g., e-mail), calendaring, and access to existing Web capabilities.

2.2 Long-Term Concept of Operations: The Web-Enabled Agency

The transitional model lays a foundation for the FAA to pursue transformational business opportunities that are characteristic of a world class Web presence. Such opportunities include those that will or have been identified in the FAA Enterprise Architecture (including the NAS Architecture). There are many potential Web-supported targets during a post-consolidation period; indeed, one of the characteristics of a Web-enabled agency model is that it provides a governance structure for continuously evaluating and prioritizing investment opportunities.

The strong, detailed business case developed for the *transitional* model continues to be a guide for development during the shift to the *Web-enabled agency* model. Again, business case development is not an event that justifies a Web program; it is a process that guides investment resources toward the most promising and effective opportunities.

The business case to decide which FAA functions can best benefit from these approaches or technologies, as well as to justify and prioritize these opportunities, has not been developed yet[3]. Potential investment and development targets for a Web-enabled agency model at the FAA include:

- Conducting business transactions on the Web, including system-to-system interaction as defined by "Web services" technology.
- Enabling more complex citizen/business interactions with the FAA, including electronic signatures.
- Supporting communities of interest within the FAA as well as with FAA constituents.
- Shifting from a "Web site-oriented" concept of operations to a "Web-enabled agency" concept of operations. This shift will require a change in the FAA's concept of operations from a localized, fragmented approach for delivering content and services through the Web to a more unified, enterprise-driven approach. This shift is not a matter of merely "improving the Web site," but of transforming the FAA's approach to several critical elements of operation:
  - o Security.
  - o Content and service delivery.
  - o Capital investment and funding.
  - o Operations and maintenance.
  - o Governance of enterprise Web policies and processes.
  - o Technology architecture and infrastructure.
- Using the Web to further reengineer agency business processes.
- Using shared Federal Government applications (including Quicksilver applications).
- Leveraging the content management system via a portal. A CMS enables more effective implementation of portal technology by providing the robust publishing capabilities required for personalized or role-based content delivery. For the FAA, portals may be useful for pushing content to known groups of users (or to individual users, if required), including dynamic content if needed[4]. (These efforts should not duplicate internal collaboration capabilities.)

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[3] Two Columbia University professors offer the following cautionary note, "Some analysts of government operations have considered the web as a potentially revolutionary force in service delivery. The impression we gain from this study is that the impact of the web on government service delivery will be slow and incremental. It will likely result in gradual, small-scale service enhancements. Customers will be provided with alternative modes of access to government and will notice some improvement in service delivery. In some instances the cost of service delivery will be reduced. When mistakes are made, or when redundant points of access are provided to please customers, the costs of service delivery will rise." The Use of Internet in Government Service Delivery, Steven Cohen and William Eimickie, Columbia University, February 2001, p.11.

[4] However, the Andersen Study points out drawbacks to portal technology: "Government agencies have gotten caught up in what we like to call 'portal mania'—an approach to user interface design based on the model used by Yahoo! and other commercial portals. This interface design model is appropriate for a true portal (such as FirstGov)

- Providing custom-designed Web capabilities for FAA PDA users, or for other forms of wireless Web access.
- Enabling public collaborative participation in public policymaking and in rulemaking in which the FAA has a role (i.e., E-Democracy).
- Providing an infrastructure that is used by both our Internet and Intranet capabilities.

An FAA business case for Web development needs to explore the opportunities for synergy between efforts to support FAA business objectives by delivering content and services to internal constituents (employees), as well as external constituents (e.g., citizens, airlines, service providers, other Federal agencies).

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that provides centralized access to many different and unrelated sites. But the approach is inappropriate for many Federal sites which are not portals but actually comprise a number of interconnected sites. A slick front-end 'portal' that provides cover for underlying sub-sites exhibiting poor usability does little to provide users with a better experience." A Usability Study of Selected Federal Government Web Sites, Andersen/Office of Government Services, February 2002, pg. 15.

Chapter 3   Guiding Principles

This chapter presents the guiding principles that shaped the requirements described in the following chapters.   The scope of the requirements is defined around the following principles:

- The FAA will evolve to a world class Web presence providing high quality, timely and accessible information and services to its customers. This principle is aimed at aiding the agency in achieving its IT Strategy E-Government goal. Consistent with the PMA, E-Government, and Section 515 (Information Quality), the FAA Web site will publish information and provide effective interactive services to its customers.
- Evolution of the FAA Web environment will reduce burdens on agency customers by better leveraging Web-based technologies.
- The FAA Web presence will strive to offer a common FAA appearance ("look and feel") and a consistent message across all external FAA Web sites. Like all Web sites, it will strive to offer an easy to use interface and navigation.
- The FAA Web presence will apply its current security policies and practices in order to secure its functions and information exchanges.
- Consolidation of FAA Web resources will increase efficiency, security, information quality, and customer satisfaction.
- The FAA Web presence will be managed through the Web Policy Council in order to provide FAA organizations a role in guiding the FAA Web presence.
- Content will be organized by identified taxonomies and communities of interest.

Chapter 4   Content and Services Requirements

The user perspective is key for the content and services requirements. The content and services requirements deal with how information is presented, or made available, to the user and the operations that a user can perform.   While the information itself is managed through the Web Policy Council and the proposed governance process, what the user actually sees and can do is the focus of the content and services requirements. These requirements are made up of both functional requirements, as well as those dealing with Web interface and design. They apply to information and services made available by the FAA through its Web presence, and it is expected that they will be developed over time.

Based on the concept of operations, best practices research, and the existing FAA external Web capabilities, the following requirements have been compiled. They take into consideration and reflect researched private and public sector best practices and standards coming from Giga, Corporate Executive Board, and various Internet subject matter Web sites. The latter are available in Web design standards documents (including FAA's design standards) and a study[5] done by Macromedia for the IT Division of the Office of Acquisitions (ASU-500).

4.1   Summary: Key Content and Services Requirements

The user is given a single point of entry for Web access to FAA content and services.   The content and services are customized based on the needs of different types of users, yet shown with a consistent look and feel, utilizing easy, clear, and intuitive online operations. Users do not need knowledge of the FAA's organizational structure to get information or perform electronic operations or transactions, and multiple navigation paths exist to key types of content. Additionally, the information and services that are made available to the user comply with applicable laws, regulations, and policies.

4.2   Functional Requirements: User Information and Services

The FAA's Web presence shall:

4.2.1   Provide a combination of information and services through a single point of entry interface (the FAA home page and pages within its scope).   This includes static and dynamic content. Such information and services shall be developed over time consistent with the target capabilities identified in the FAA enterprise architecture (especially its business and application architecture). Categories of these information and services include:

4.2.1.a   Aviation safety information – including accident investigation information, aircraft registration and certification information, airmen licensing and medical qualification information, database inquiries, etc. Access to the National Aviation Safety Data Analysis Center (NASDAC) is oriented toward this purpose and is publicly accessible.

4.2.1.b   Traveler and air traffic information and services - including airport status (www.fly.faa.gov)[6], runway visibility, airline on-time statistics, and Notices to Airmen. Runway safety data and unruly passenger statistics are also available online.

4.2.1.c   Aircraft registrations and certifications – The relevant FAA Web pages assist an aircraft owner to register the title of their aircraft and an aircraft manufacturer to request certification of the airworthiness of their new or modified aircraft.

4.2.1.d   Aircraft inquiry - allows a user to make an inquiry about the registration of an aircraft. In addition, the FAA database of registered aircraft is available for download.

4.2.1.e   "Do It Yourself (DIY)" Web site (www.diy.dot.gov) – This is an FAA developed and maintained Web site for the Department of Transportation (DOT) as a whole. It is the DOT's online payment site so that citizens and businesses can perform financial transactions relating to registrations, fee payments, fines, penalties, and Freedom Of Information Act (FOIA) payments. The Flight Standards Service (AFS) uses this Web site for the aircraft registry and airmen certification functions.

4.2.1.f   The airmen inquiry Web site is maintained by AFS and allows airmen to inquire about the status of their certification as airmen.

4.2.1.g   Public affairs information, including press releases.

4.2.1.h   Commercial Space Transportation information and services.

4.2.1.i   Rulemaking – information about existing and proposed rules, regulations, advisory circulars, and standards are important to a variety of stakeholders including airlines, pilots, and FAA employees.

4.2.1.j   How Do I? - The FAA has a number of Web pages (How Do I?) devoted to answering questions such as: how do I become a pilot?, how do I become a controller?, how do I report a safety violation?, and how do I do business with the FAA?

4.2.1.k   Ask FAA – pointers to answers to a variety of frequently asked questions or topics.

4.2.1.l   Support procurement and grant-making processes.

4.2.2   Provide Web capabilities customized for types of FAA customers and profiles using personalized portal design approaches/technology and access to information and services.

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[6] This Web site can be used by the traveling public to check on any delay conditions at an airport they are traveling to or from. This is real-time information to aid a traveler.

4.2.2.a   Business customers: airlines, aircraft manufacturers, maintenance shops, flight training schools, universities, aviation-related associations, suppliers, and contractors (Government-to-Business (G2B)).

4.2.2.b   Citizen customers: pilots, flying public, public affected by FAA rulemaking, and other (Government-to-Citizen (G2C)).

4.2.2.c   Government entities: states, localities, airport authorities, National Transportation Safety Board (NTSB), Department of Defense (DoD), National Aeronautics and Space Administration (NASA), National Oceanic and Atmospheric Administration, Bureau of Transportation Statistics (BTS), and International Civil Aviation Organization (ICAO) (Government-to-Government (G2G)).

4.2.2.d   FAA employees (Government-to-Employee (G2E)).

4.2.3   Support electronic forms (e-Forms) capabilities in support of GPEA transactions. This includes using a standard e-Forms package to author and post electronic forms to our Web site (http://www1.faa.gov/forms/) so that the public can download such forms, fill them out, and submit them to the FAA (when required). (Automatic acknowledgements of electronically submitted forms are returned.)   One or more types of forms will need to be supported such as:

- Electronic form available on the Web, easily accessible, Section 508 compliant, in "open" format ("print and fax").
- Fillable electronic form available on the Web, easily accessible, Section 508 compliant, in "open" format ("fill and e-mail").
- Fill, electronically sign (if required), and submit electronic form available on the Web, easily accessible, Section 508 compliant, in "open" format ("fill and submit").

4.2.4   Support Webcasting (streaming video and audio). This includes interviews with FAA executives and managers addressing major crosscutting topics and programs.

4.2.5   Provide a robust and fully functional search capability. This includes having a quality search engine, managing the files included in the search engine's database so that they have proper metatags to enable finding the relevant document, and including Web Uniform Resource Locators (URL) in the search engine database (not just files). The search capability should distinguish between information publicly available and For Official Use Only (or other security classifications) so that only publicly available information is presented from the search engine on the FAA external home page. This may include heuristic search capabilities.

4.2.6   Be findable from major commercial browsers through keywords/metatags. Content authors must provide keywords or metatags to Web programmers. When creating a Web page for inclusion in the FAA Web site, the content owner must define keywords or metatags that are search phrases for finding the Web page from a search engine such as

www.google.com or other commercial search engines. The keywords must be thoughtfully selected in order to increase the likelihood of the Web page being found.

4.2.7 Enable users to provide feedback and obtain contact information; the FAA can then respond to feedback, when necessary, in a timely manner using the predefined user categories. This includes a way for a Web user to e-mail the FAA Webmaster to report problems, ask questions, or make suggestions. The contact information shall include the FAA mailing address and main phone number.

4.2.8 Provide online help and navigation and search aids that are clear and intuitive.

4.2.9 Comply with applicable laws, regulations, and policies.

4.2.9.a Section 508 - Web resources shall be accessible to people with disabilities as required under Section 508.

4.2.9.b E-FOIA - The FAA Web environment shall be the primary FAA method for providing an electronic reading room to enhance public involvement and governmental accountability as required under the E-FOIA Act of 1996. (This also has a business benefit of reducing the time and cost to respond to individual FOIA requests.)

4.2.9.c Federal Records Act -The FAA Web sites and pages shall be managed in a manner compliant with the Federal Records Act to assure accurate and complete documentation of the policies and transactions of the FAA in order to provide judicious preservation and disposal of records.

4.2.9.d Privacy - Comply with the Privacy Act, as well as with OMB privacy guidelines, including privacy notification requirements.

4.2.9.e Section 515, Information Quality requirements (Section 515 of the Treasury and General Government Appropriations Act of FY2001) – Comply with Information Quality requirements (including the DOT Information Dissemination Quality Guidelines).

4.2.9.f Comply with and support the GPEA through electronic forms and transaction capabilities.

4.2.9.g Children's On-Line Privacy Protection Act (COPPA) – Comply with all aspects of COPPA.

4.2.9.h Comply with FAA and National Institute of Standards and Technologies (NIST) information systems security policies and standards, as well as those directed by OMB Circular A-130 Appendix III.

The FAA must ensure that all information systems are protected from threats to integrity, availability, and confidentiality. This includes FAA Web resources, particularly Web servers. FAA information systems depend on adequate information security for proper operation and

protection from unauthorized access and modification. The increasing number of network-based attacks, the reliance on the Internet for quickly communicating information, and the vulnerability of information systems to exploitation by threat agents require a rigorous information systems security (ISS) approach to protect FAA information systems. FAA Web centers and/or steward organizations shall ensure that security is provided commensurate with the risk and magnitude of the harm resulting from the loss, misuse, or unauthorized access to or modification of information for information collected, processed, transmitted, stored, or disseminated in their Web sites and related information systems. Specific requirements are further detailed in FAA Order 1370.82 and related ISS policies and orders. Selected requirements include developing a security certification for Web servers, identifying security requirements for Web resources (includes countermeasures to reduce the effectiveness of threats, including computer viruses and other forms of unauthorized or malicious codes), ensuring sufficient funding for those requirements, implementing those requirements, and making use of incident monitoring, tracking, and response capabilities.

4.3   Web Interface and Design

The FAA's Web presence shall:

4.3.1   Be designed consistent with FAA Web-related standards including design and usability standards together with prescribed FAA Web page templates and application program interfaces. FAA Web resource capabilities shall be provided in a clear, easy to find manner delivered as quickly as possible. This includes the current version of the FAA Website Design Standards and Instructions (Internet only). Use of such standards is a key way to attain a common "look and feel."

4.3.2   Present a consistent look and feel to users ("One FAA"). Provide for clear corporate branding of the FAA's mission. Make use of "one-stop shop" or central gateway design concepts (from E-Government).

4.3.3   Provide unified and simplified access to content and services. The need is for users to be able to access required content rapidly in a simple way. This is sometimes described as "3 clicks to information."

4.3.4   Present information/services in multiple ways (e.g., searching and browsing). This involves supporting alternative navigation and search methods including a site map, Ask FAA, search engine, "How Do I?", and other capabilities. One characteristic of better Web sites is the availability of several ways to enable a user to find the information they need even when dealing with a Web site for the first time.

4.3.5   Present its content and services to the public by services and information topics rather than by organization. It is better to design an external Web so that external users can find what they need without having knowledge of FAA's organizational structure.

4.3.6   Have a marketing strategy for its Web presence and permit changes to that strategy. A Web marketing strategy is a best practice in industry for positioning one's Web

presence effectively. Such a strategy involves applying public relations, marketing, and Web design techniques to our Web presence. This includes defining the branding concepts to be included in the Web templates. Marketing and branding defines one's organizational message that influences stakeholder, customer (e.g., airlines, pilots), and future employee impressions of the organization.

4.3.7   Provide accessible content and services via multiple formats/browsers and capabilities. The FAA Web site shall be compatible with major commercial Internet browsers including the two most recent versions of Netscape and Microsoft Internet Explorer (IE). (Client access shall be done via a browser.)

4.3.8   Provide PDAs and pocket personal computers (PC) access to FAA Web resources if they comply with FAA specified security requirements, e.g., digital certificates.

4.3.9   Enable content owners (often not technical staff) to author their content for the Web and submit it for acceptance in an electronic manner.

Chapter 5 **Technology Requirements and Architecture**

5.1 Introduction

This chapter presents snapshots over a period of time of how the Concept of Operations (CONOPs) will mature to transform the FAA from a Web site-oriented agency to a Web-enabled agency. This chapter also demonstrates how the infrastructure of the FAA should transition to enable the Content and Services requirements, as defined in Chapter 4, and depict a world class Web architecture. Three key elements within the CONOPs are:

- Content and Services.
- Technology.
- Governance Management.

As the three key elements within the CONOPs mature, they develop synergies that work in harmony to congruently attain the desired end-state of a Web-enabled FAA. This end-state will achieve maximum benefits spanning economies of scale and satisfying business drivers.

5.2 Scope of the Technical Requirements

The business drivers primarily drive the requirements presented here and the requirements defined in the Content and Services Requirements chapter. If the FAA decides to provide these content and services to the customers or the constituents (G2B, G2C, G2G, G2E), there will be significant impact on technical or Web architecture. The scope of the technical requirements is to provide high-level understanding of what the FAA needs to meet the content and services requirements. The requirements will not scope out hardware or software requirements; rather, they will scope out technologies and standards available to meet the strategic IT needs related to the content and services defined.

5.3 Summary: Key Technology Requirements

The ability to deliver content and services can be materialized by a technical architecture that provides the FAA with the ability to transition from a simple Web site to a more federated model of Web site management and governance. The key technology requirements (Figure 6) for the technical architecture that will support the concept of operations are structured according to the evolution described in the Web Maturity Model: "Web Site-Oriented Phase I", "Transition Phase II," and "Web-Enabled Agency Phase III" requirements.

Data development and maintenance relating to Web applications must be performed following the requirements in FAA Order 1375.1C, Data Management, dated June 20, 2001.

Web Site-Oriented Phase I	Transition Phase II	Web-Enabled Agency Phase III
Infrastructure Requirements		
Distributed Content	Establish a Content Management System	Enhance the Content Management System via XML
Static Content, not customer-centric	Enable Web resources consolidation	Enable Web resources and enterprise applications integration using Databases Middleware & EAI
Content ownership and accountability not clear	Enable limited transaction capability	Enable transaction capabilities via Web services
"Ad Hoc" Publishing	Enable dynamic content publishing	
Performance Requirements		
Decentralized Infrastructure	Provide a scalable, reliable, and extensible architecture via 24/7 availability of system with load balancing, synchronization, and backup/recovery/failover	Improve the scalability and reliability via a robust network & hardware infrastructure to support efficient and seamless Web management
	Provide Web management, monitoring, and diagnostics capabilities	Measure Web performance and content usage by constituents
	Improve network bandwidth & Web content caching capability to improve end user access experience	
	Improve response time such that FAA home page loads quickly	
Security Requirements		
Implementation of Firewalls	Enhanced firewalls and encryption technologies, such as SSL, and identification verification approaches to enforce access control against cyber attacks	Improve Security - using Single Sign-On and LDAP
Low governance		Support auditing initiatives - Security auditing and Web Quality of Service
		Introduce Web services security standards

Figure 6 - Matrix of Key Technology Requirements

The following sections discuss the drivers of these requirements, the details of the requirements, the benefits expected, and the how the requirements will develop as the FAA transitions from a Web site-oriented to a Web-enabled agency. The most important and immediate phase is the "Transition Phase" and, therefore, most technology requirements are focused around this phase.

5.4   A Strategic Phased Approach

The Web Maturity Model (Figure 3) provides a three-phased strategic approach toward the Web architecture development. The three phases are:

- *Web Site-Oriented Phase I* – A decentralized environment with low governance.
- *Transition Phase II* – A consolidation phase for FAA Web infrastructure in terms of Web servers, Web sites, content, tools and technologies used. The Web architecture discussed in

this chapter goes into much more detail as compared to other phases, since Phase I is simply the existing state and Phase III is where the FAA is going to in the future. Thus, the focus is on the more immediate future state as defined by Phase II.

- *Web-Enabled Agency Phase III* – The vision of a Web-enabled FAA Phase III is a strategic direction toward the ultimate goal of the FAA to be truly a Web-enabled agency. Phase III enables the FAA to meet the constituents needs and exceed their expectations in terms of service delivery and effective content management.

This chapter provides some technical, as well as functional, requirements around the key technology components required during each phase of operations and Web architecture maturity. The Web architecture presented at the end of Phase III is the envisioned state of the Web infrastructure that supports open standards and provides opportunities to FAA to provide new content and services to its customers, partners, and employees.

5.4.1 Web Site-Oriented Phase I

The Web Maturity Model (Figure 7) provides a framework for the FAA to analyze the capabilities of existing and future Web infrastructure in terms of the content and services that can be delivered at each stage. This model also indicates the role of effective management and
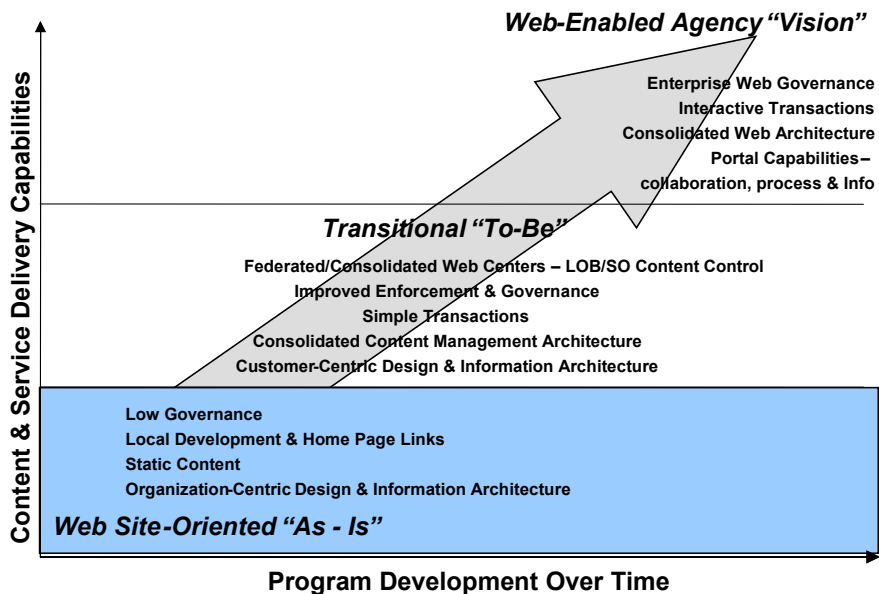
governance at each stage.

Figure 7 - Web Maturity Model - Web Site-Oriented Phase

The current FAA Web infrastructure is distributed and supports multiple Web servers and Web sites (Figure 8). The content is mostly static and the delivery of content is mostly ad-hoc. The key limitations of such an architecture are:

- Distributed content.

- Content ownership and accountability is not clear.
- Governance issues related to distributed content.
- Static content, not customer-centric.
- No analysis of content usage.
- Access to users via browser.
- Existing security model cannot support future Web-enabled operations.

Figure 8 shows the degree to which the current environment is distributed and how many applications (e.g., document store and Lotus Notes) are not integrated with the current Web environment. Concerning use of the Internet by FAA data marts or warehouses, the FAA's NASDAC is available from our external home page for aviation safety analysis purposes. Currently, the users can access the content via Web browser only.
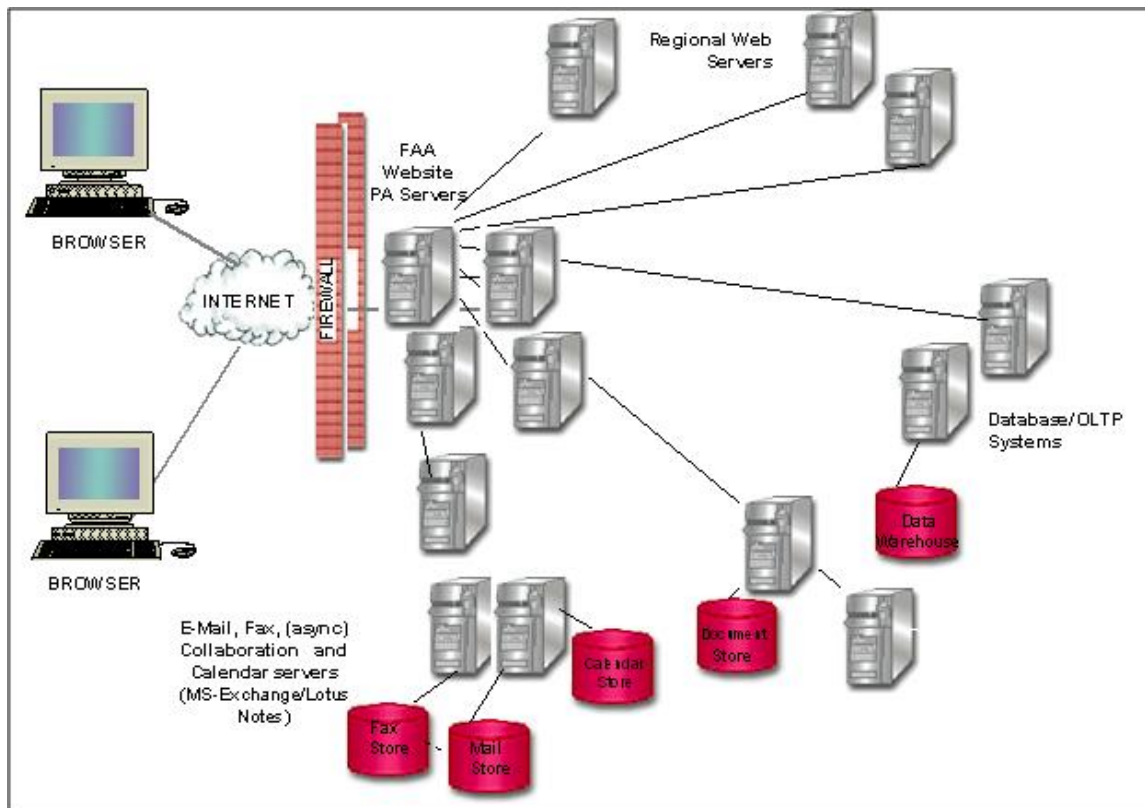
Figure 8 - The Current FAA Web Infrastructure – Distributed

In order for the FAA to initiate Web infrastructure and content consolidation, the FAA needs to move into the transition phase of the Web Maturity Model.

5.4.2 Transition - Phase II

During the transition phase of the Web Maturity Model (Figure 9), the FAA consolidates Web resources, implements corporate-wide content management, and attains consistent Web content compliance with regulatory requirements. This enables the FAA to attain many E-Government objectives and be positioned for further E-Government opportunities. Better content management and consolidated Web infrastructure enable a better user experience and provide the FAA with economies of scale.

5.4.2.a   Transition Phase Requirements

As the FAA moves from a simple Web site orientation to a more federated model of Web site management and Web infrastructure consolidation, the following requirements apply:

- Content Management System (CMS).
  - o   Content consolidation.
  - o   Centralized content delivery and publishing.
  - o   Establishing work flows around content management.
  - o   Content usage analysis to effectively manage content and Web resources.
- Interactive and collaboration capabilities
- Web resources consolidation.
- Scalable and reliable infrastructure.
- Improve security using Secure Socket Layer (SSL), PKI, or other methods.
- Improve user access and experience.
- Federated approach towards governance (discussed in Chapter 6, Management Requirements).
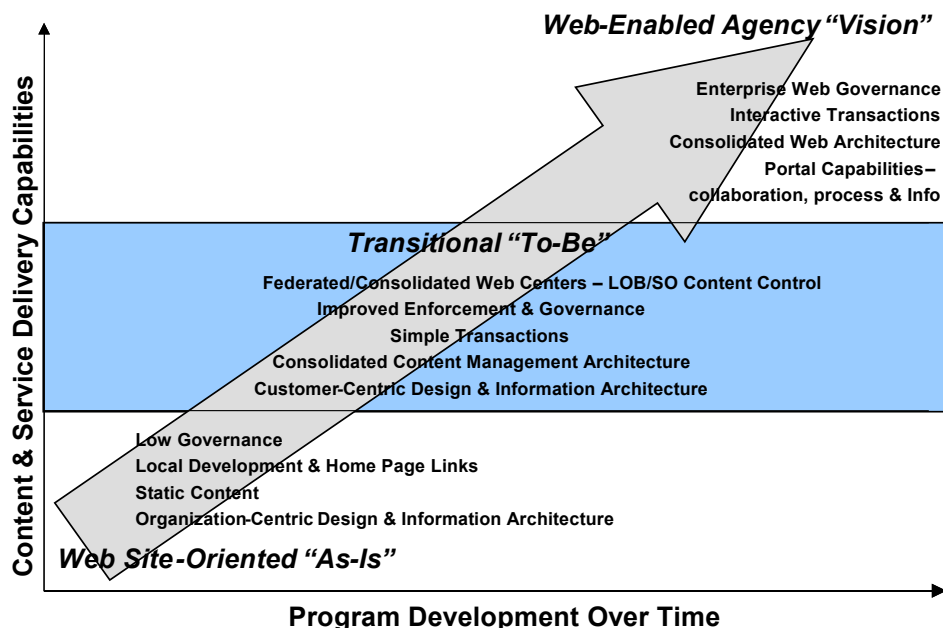
Figure 9 - Web Maturity Model – Transition Phase

To meet the technical requirements, the FAA needs a Consolidated FAA Web Infrastructure as shown in Figure 10 below.

The new architecture is able to provide access via multiple Web browsers, as well as provide the capability for future access via mobile devices (e.g., PDAs, cell phones). Security is provided by the implementation of SSL and PKI.

<div align="center">5.4.2.a(1) CMS Requirements</div>

The new architecture (Figure 10) consolidates multiple Web servers and Web sites and creates a logically centralized environment via a CMS. A CMS would provide the FAA with the following capabilities:

- Multi-site management.
- Workflow management.
- Collaboration to enable content sharing.
- Organization of content.
- Analysis of content usage.
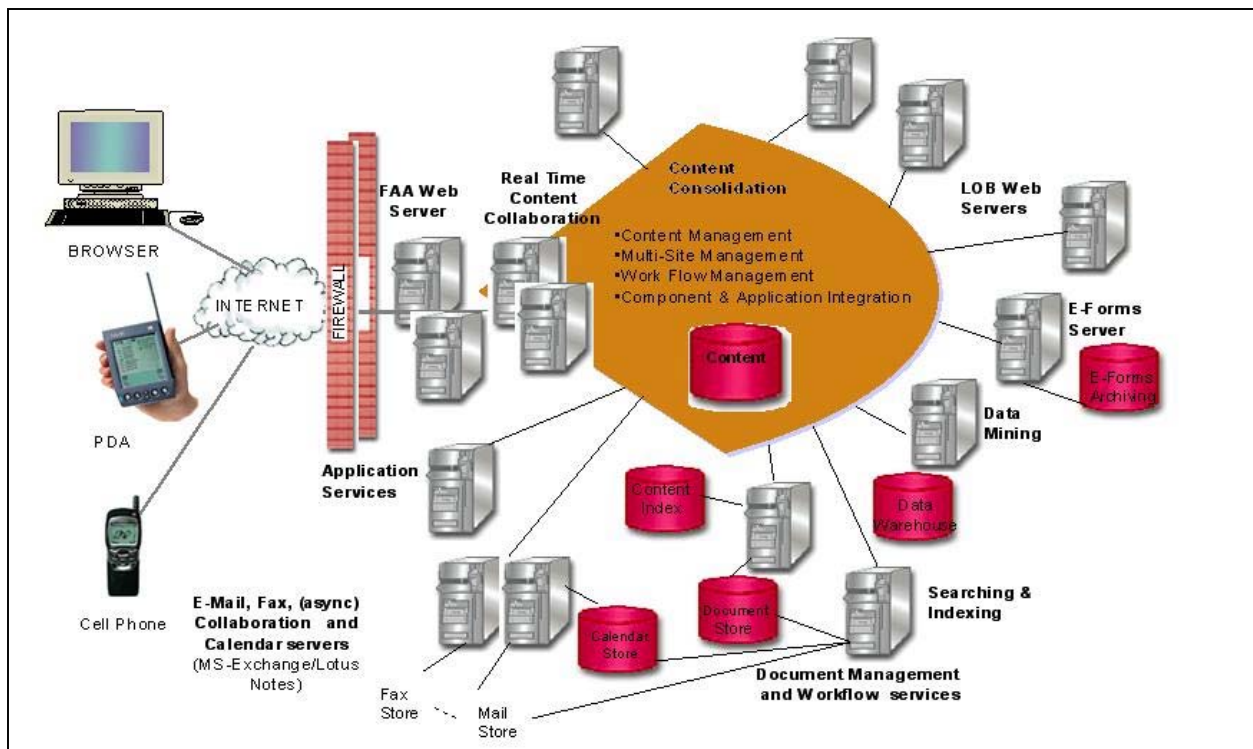
Figure 10 - The FAA Web Infrastructure – Consolidated

- Multi-site management. The new FAA Web infrastructure provides multi-site management capabilities. Two aspects of multi-site management are:

  o Aggregation – The content from various Web sites and LOBs are staged and centralized; the content is managed as distributed content through a centralized content repository.
  o Inheritance – Create child sites that inherit all or part of the characteristics of a parent site.

  Benefits of multi-site management: The FAA is able to centrally manage content and the metadata from many sources and LOBs. The FAA has better-controlled deployment through staging with in-depth reporting and monitoring. The FAA is able to rapidly deploy to hundreds of sites while maintaining a consistent look and feel. This helps reinforce branding and messages, preserves FAA corporate identity, and maintains standards and quality.

- Workflow management is a key feature of the new FAA Web infrastructure. Two aspects of workflow management are:

  o Workflow – Controls the routing of content through the preparation process from conception to final approval and posting.
  o Predefined Roles – Roles such as creator, editor, approver and others control workflow.

 Benefits of workflow management: The FAA is able to establish workflow cycles with predefined participant roles to help provide quality assurance and control during the development of content. An online and automated workflow system also makes it possible for FAA to rapidly update existing content or produce additional content in a very short cycle. The FAA can dramatically reduce time and cost to deploy small or large amounts of content.

- Content Usage Analysis enables FAA content to be organized in taxonomies. The FAA can do a content usage analysis" to highlight out-dated content and organize high usage content into taxonomies. Three examples of taxonomy methods are:

  o Predefined content tagging and site instrumentation.
  o Content usage reports based on site, channel, content categories, user segmentation, provider, content type, and content item.
  o Interaction data analysis.

  Benefits of content usage analysis: Content and site usage reports provide FAA with a deeper understanding of content usage. These reports provide FAA with filtering options allowing users to define specific information. By allowing business users the insight into how the Web site content is being used, interactions can be more productive creating a more efficient online experience.

- Content Organization. The new FAA Web infrastructure provides for better content organization. Three aspects of content organization are:

o   Content types – Includes forms, reports, calendars, state and country lists, etc.

o   Taxonomies – Hierarchical word relationships for general business terms and specialty fields such as airlines, pilots, air traffic controllers, maintenance crew, and airport authorities.

o   Search engine – Search engine with Boolean search capabilities.

Benefits of content organization**:** The search engine and content types can reduce development efforts for FAA and provide users with effective tools for content navigation and location. Taxonomies provide multiple benefits with the ability to quickly add intelligence to content. Content relationship is valuable for analyzing user behavior and content relevance. In addition, taxonomies enable the delivery of core content in multiple formats by different topics.

- Interactive and collaboration capabilities. The new FAA Web infrastructure provides interactive and collaboration capabilities. Collaboration provides a unified corporate image for the FAA. Collaboration reduces costs and takes the FAA content sharing to another level. Four examples of collaboration are:

o   Virtual team room – Online conferencing with chat, screen sharing and file viewing can be provided by a content management system.

o   Collaborative file management – The FAA is able to manage and share files among multiple users.

o   Threaded discussion groups – The FAA is able to provide automatic organization of responses and replies to a posted question or subject for user communities such as pilots, airlines or other citizens.

o   e-Forms – The FAA is able to provide electronic forms creation and submission as interactive capabilities.

Benefits of interactive and collaboration: Collaboration of content enables the FAA to manage information and simplifies online communication among multiple participants. FAA applications can be customized and integrated with other content services such as workflow to provide a comprehensive solution using interfaces and tools that are industry standards.

5.4.2.a(2) Web Resources Consolidation

As the content and services grow there is a need to consolidate Web resources and build a more robust and scalable solution. Decentralization has resulted in many LOBs having dozens of servers at regional locations.

There is a growing sea of servers: deploying these systems in a decentralized fashion "one-at-a-time method" has been used to date. The FAA has an opportunity to collapse dozens of servers onto a single platform and take a consolidation approach toward management of these Web resources (Appendix D, section D.7).

There are a number of advantages of consolidation, such as:

- Lower total cost of ownership: Consolidation will help the FAA reduce complexity, implement better systems management practices and optimize capacity utilization.
- Improved service levels: A more efficient infrastructure is better managed when consolidated. This implies that consolidation can help the FAA enable the applications that drive the consolidated infrastructure to deliver increased data access, higher levels of availability and faster response times to end users.
- Increased security: FAA customers require their secured information to be managed effectively and in a centrally consolidated environment.

Web resources consolidation makes management simpler because technicians will work with one system rather than a series of distinct systems. In addition, this approach offers the FAA more scalability opportunities.

When examining server consolidation, IT managers need to be aware of the limitations associated with this approach. One important issue is the server becomes a central point of failure; a problem with it could knock all users offline. In comparison, the single server approach impacts only those users working with a particular application. Section 5.4.2.a(3) addresses some issues around load balancing and fail over protection to overcome these limitations.

- Capacity Planning for the FAA: The consolidation of Web resources leads to effective capacity planning through realized efficiencies and centralization of management. As more content with a higher quality of service is delivered, more attention on the requirements for capacity planning, reliability and scalability are needed. (Refer to Appendix D, Section D.9 for best practices on capacity planning.)

5.4.2.a(3) Scalable and Reliable Infrastructure

Once the FAA moves to the transition phase of the Web Maturity Model, a more reliable and scalable Web architecture is needed to support the content and services defined. This architecture can be built using clusters of interconnected Web and application servers.

The FAA Web portal provides 24x7 operation and 99.99% availability to the customers. To accomplish such availability Web servers are clustered. Reliability is a key advantage that arises from clustering, because some clusters include management software that reallocates the workload of a server that fails. This helps the FAA minimize downtime for the Web site.

- Clustering and Load Balancing: Typically, load balancing is the main reason for Web server and application server clustering. The FAA Web sites use load balancing. For load balancing Web traffic, there are several approaches. For Web servers, one approach is to route each request in turn to a different server host address in a domain name system (DNS) table, round-robin fashion. Usually, if two servers are used to balance a workload, a third server is needed to determine which server to assign the work. Since load balancing requires multiple servers, it is usually combined with failover and backup services. In some approaches, the servers are distributed over different geographic locations. Depending on the number of users,

one of the load-balancing approaches will be chosen. A typical approach is shown below in Figure 11.

- Failover: Failover is a backup operational mode in which the functions of a system component (e.g., a processor, server, network, or database) are assumed by secondary system components when the primary component becomes unavailable through either failure or scheduled down time.

To accomplish 24x7 operation and 99.99% availability, a fault-tolerant, failover system must be constantly available. The procedure involves automatically offloading tasks to a standby system component so that the procedure is as seamless as possible to the end user and FAA Web site customers. Failover can apply to any aspect of a system: within the FAA network, failover can apply to any network component or system of components, such as a connection path, storage devices, or Web servers.

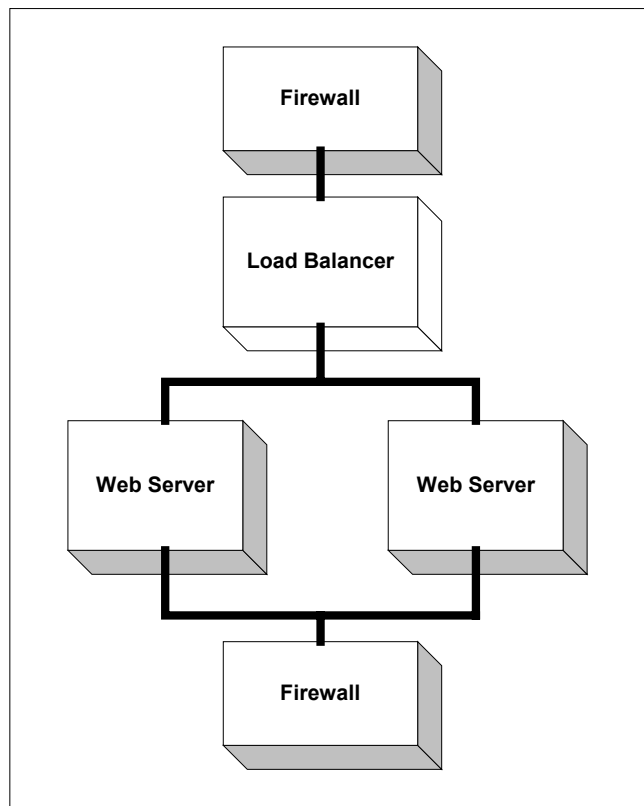**Figure 11 - Web Server Balancing**

- Network Bandwidth and Web Caching: From the customer perspective, one of the most important network characteristics is the speed of its connection to the Internet. Likewise, the server's link to the Internet is an important factor. Because Web servers handle so many concurrent user sessions, FAA can use both "close to the source" (such as co-location) and

multi-site server-mirroring strategies (such as multiple T-3 connections) to improve network response time.

At the client end of the connection (including regions or at the FAA Internet access points (IAP)), caching services can also provide significant performance improvements. The Web architecture includes caching servers to lower the number of outgoing Hypertext transfer protocol (HTTP) requests that must actually traverse the Internet. FAA can provide caching services/servers at each of the IAPs located at various regional locations or at the four proposed federated Web centers.

The links between what is sometimes called the "closest link" or the "last mile" on both client and server ends of any connection are often represented as a cloud. This reflects the lack of determinism in paths between client and server, and also reflects a general lack of knowledge about what is going on inside the cloud itself. This latter phenomenon helps to explain why major Web sites so often contract with response-time monitoring services so that they can simulate typical client requests, locations, and loads, and get a sense of how well the cloud is behaving at any given moment. FAA can choose to pursue a centralized network management, Web resources management, and a response-time monitoring service to improve user response times.

On the Internet, there is realistically no maximum number of users, and the architecture has to be designed to accommodate significant bursts of activity. All of the resources that participate in an application can be affected. In order to be scalable, the Web architecture needs to allow for any process to either be duplicated or queued so that it does not become a bottleneck. For Web processes likely to grow, the architecture can be implemented such that additional servers can be brought online as they are needed. The Web applications handling these processes enable the data or content to be cached whenever possible. The resulting solution is to provide load balancing and content replication whenever possible. The good news is that load balancing and caching technology allows scalability and availability to be done at a reasonable cost.

5.4.2.a(4) Improved Security

Security capabilities are available throughout Phase I through Phase III; however, at each phase FAA needs to improve security to meet the requirements of customers and the content and services they want. Security extends during Phase II via SSL and PKI.

SSL is a commonly used protocol for managing the security of a message transmission on the Internet. SSL is an integral part of most Web browsers (clients) and Web servers. SSL uses a public and private key encryption system that also includes the use of a digital certificate. (The latter ought to be consistent with FAA X.509 Certificate Standard or other similar source of requirements.) All the Web servers will be secured by using SSL (see Appendix D, section D.6 for additional details).

PKI enables users via the Internet to securely and privately exchange data through the use of a public and a private cryptographic key pair that can be obtained and shared through a trusted authority. PKI provides for a digital certificate that identifies individuals or organizations and

directory services that store and, when necessary, revoke the certificates (see Appendix D, section D.6 for additional details).

Although the Web architecture discusses Web server and browser security requirements, there is a need to secure content via a content management system, or data provided by databases, or other enterprise applications. Similarly, there are requirements to secure the FAA network. These requirements are out of scope for this document.

5.4.2.a(5) Improved User Access and Experience

Users have the capability to access content via Web browsers, PDAs, or other mobile devices.

The end user or customer experience is enhanced by:

- Quality of content
- Dynamic content that will provide the most up to date information
- Reliable and scalable Web resources
- Content caching at Web centers
- Network bandwidth
- Secured access

Finally, this transition architecture provides an opportunity for the FAA to integrate enterprisewide applications with the Web and incorporates additional capabilities to integrate with the FAA's Intranet. The transition phase of the Web Maturity Model is, in fact, a new beginning for the FAA, a strategic move toward a Web enabled FAA. Phase III secures the transition of the FAA to become a Web-enabled agency.

5.4.3 Web-Enabled Agency - Phase III

At the Web-enabled agency phase of the Web Maturity Model, the FAA moves toward capabilities associated with concepts of a We- enabled agency (Figure 12). The Web architecture provides a higher level of integration of Web infrastructure and enterprisewide applications at the FAA. This enables better user personalization and provides the FAA with greater economies of scale as information management over the Web becomes easy and with higher degrees of governance.

5.4.3.a "Web-Enabled Agency" Phase Requirements

- Enhance CMS via eXtensible Markup Language (XML).
- Middleware and enterprise application integration (EAI) to integrate enterprise applications with Web architecture.
- Improved security using Lightweight Directory Access Protocol (LDAP).
- Enterprise data management.
- Improved user access and experience – Web services.
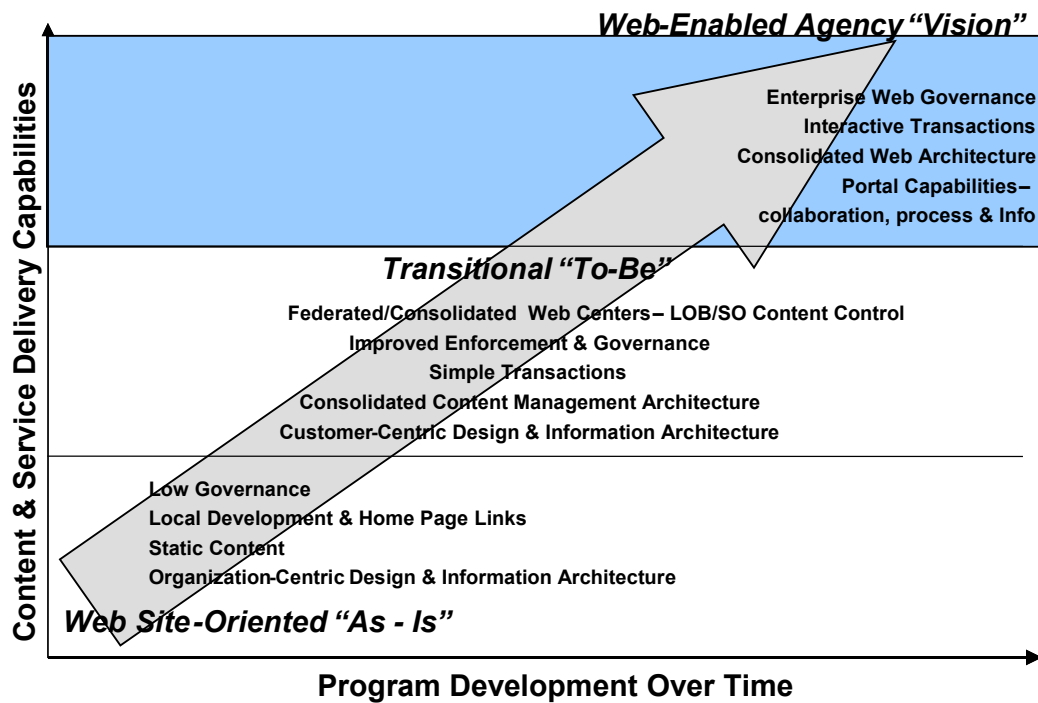
Figure 12 - Web Maturity Model – Web-Enabled Phase

5.4.3.a(1) Enhance Content Management System

XML is a likely component for FAA's Web environment. The rich metadata that XML associates with a document can also facilitate additional tasks, such as categorizing content into taxonomies.

The CMS is able to:

- Produce, manage, and deploy XML content.
- Support environments for producing interfaces for accepting and creating XML content.
- Support XML standards for data exchange with FAA partners. The primary value of XML is in the transfer of information.
- Support content appropriate for marking up in XML including programs, graphics, and other traditional binary files.
- Perform content analysis that provides the FAA with the capability to archive content, enable dynamic content, and provide users with relevant references.

The new architecture also provides the following features and applications including those necessary for using XML in an enterprise-level CMS and to support open standards:

- User authorization by means of LDAP.
- Project-based organization of content.

- Workflow that routes content through the development, approval, launch, and archive processes.
- Version control.
- Meta-characterization (that is, the data model for documents).
- Applications to transform data into and out of XML.
- Applications to aggregate and integrate content from almost anywhere, including syndication services.
- Applications to analyze and report on how content is being used.
- Applications to personalize content for a specific user or group of users.
- Applications to transform and deliver content to multiple destinations.
- Applications to package and syndicate content to external users.
- Applications to stage content to the development, quality assurance, production, and live environments.

5.4.3.a(2)   Middleware and Enterprise Application Integration to Integrate Enterprise Applications with Web Architecture

The middleware component enables EAI. Middleware architecture can be easily integrated in this environment to integrate enterprise applications as well as external applications. As shown in Figure13, the middleware messaging layer can sit on top of a content management system and integrate content from various enterprise applications. This content is the foundation for Web services and provides FAA with the ability to transact and interact with customers/users.
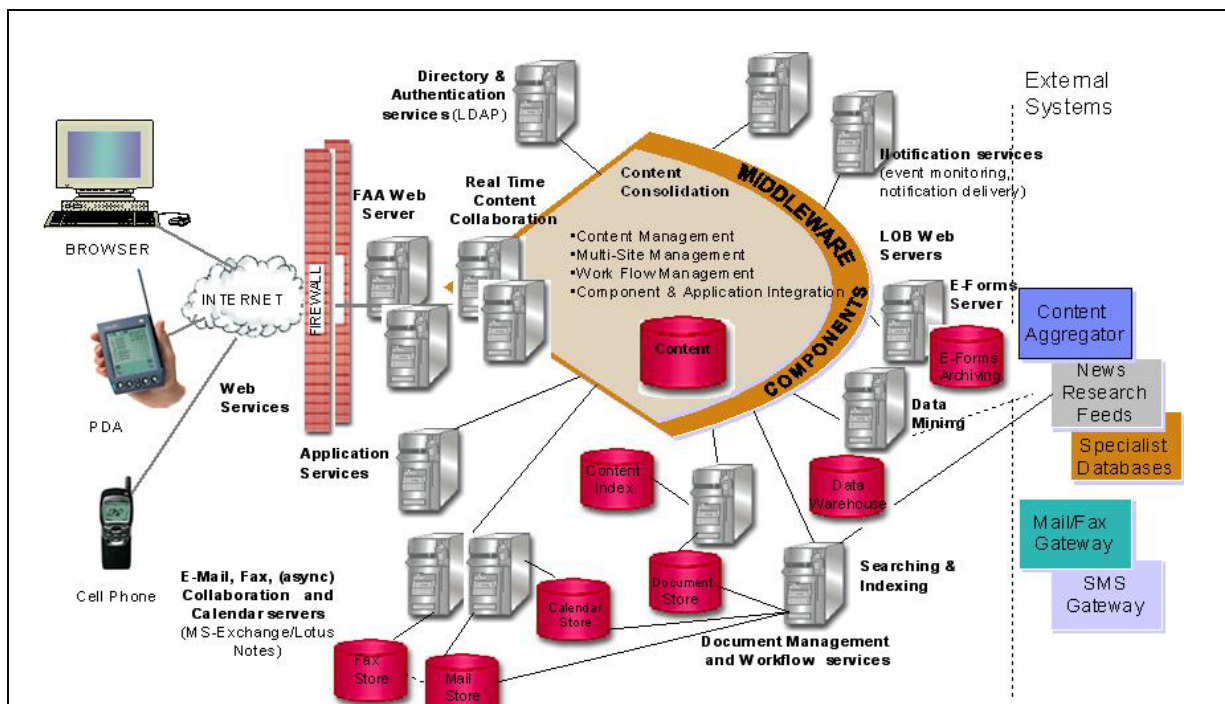

Figure 13 - The FAA Web Infrastructure as a Web-Enabled Agency

This architecture is built upon Figure 10.

This improved Web architecture and content delivery mechanism enables the FAA's existing consolidation opportunities for legacy applications, databases and external applications. EAI enables addition or migration to a new set of applications that exploit the Internet, E-Government capabilities, and other new technologies. EAI also encompasses methodologies such as distributed, cross-platform program communication, the modification of enterprise resource planning to fit a new set of objectives, object-oriented programming, enterprisewide content, and data distribution using common databases and data standards implemented with XML, middleware, message queuing, and other approaches.

The benefit of incorporating EAI, XML, and CMS is to enable the FAA Web infrastructure to evolve and support open standards. Some of the key guidelines of the Federal Enterprise Architecture Program Management Office are also addressed via this Web architecture.

The new Web architecture enables personalization of content and services. Personalization is the ability of a Web site to tailor its content to the needs of a group of users (such as general aviation pilots) or to a specific individual. This can be based on the characteristics of the group or the individual using information provided by the user or gathered by the site (e.g., a particular user's page sequence pattern).

Finally, the notification services enable information push; users/customers can subscribe to an alert service based on their personalized content or the dynamic data feeds. In this way, users can benefit from event-based information such as weather or airport delays.

5.4.3.a(3) Improved Security Using LDAP

As shown above in Figure 13, a directory server is added to the architecture, which provides native LDAP services. Information stored in the LDAP directory server coupled with other capabilities is useful for authentication and authorization of users to enable secure access to enterprise and Internet services and applications. This ensures access control policies are applied across all communities, applications, and services.

5.4.3.a(4) Enterprise Data Management

Enterprise data management constitutes a necessary core for successful Web architecture in the Internet. At the FAA, best practices show that delivery of quality information (the right information at the right time to the right customer) is key to a productive Web experience. This requires high quality information and data, data standards, and data registration. In addition, as mentioned above, high availability is an important requirement of any Web architecture. As such, it is important to carry this concept into the data/content sources or the relational database management system (RDBMS).

5.4.3.a(5) Improved User Access and Experience – Web Services

In addition to all the benefits derived from Phase II, this Web architecture enables users to interact and transact over the Web via Web services. "Web services" (also called application

services) are services that are made available from the Web servers for users or other Web-connected programs. Providers of Web services are generally known as application service providers. Web services range from such major services as storage management and customer relationship management down to much more limited services such as the furnishing of weather information to pilots and travelers via portlets. The accelerating creation and availability of these services is a major Web trend.

Users can access some Web services through a peer-to-peer arrangement rather than by going to a central server. Some services can communicate with other services and this exchange of procedures and data is enabled by middleware. Besides the standardization and wide availability to users and businesses of the Internet itself, Web services are also increasingly enabled by the use of XML as a means of standardizing data formats and exchanging data. XML is the foundation for the Web Services Description Language.

As Web services proliferate, FAA concerns include the overall demands on network bandwidth and, for any particular service, the effect on performance as demands for that service rise.

Chapter 6   Management Requirements

This section describes the management and governance processes needed for a Web-enabled agency.

6.1   Current FAA Web Governance Model

The current decentralized approach to managing our Web environment does not allow for effective content delivery or efficient operation. While the Web Policy Council and APA have provided policies and some design standards, the LOBs and SOs manage their Web resources independently. This decentralized model allows a great deal of leeway and, although it may foster innovative use of the Web, it is a bottom-up approach to evolving our Web capabilities.

A decentralized approach becomes increasingly expensive as each LOB and SO deals with infrastructure support issues: Web server administration and maintenance, procurement of Web tools, Web hardware planning and acquisition, Web usage tracking and analysis, systems security, Web staff training, etc. With a decentralized approach, each LOB/SO develops Web technologies independently, making it difficult to ensure the complete and consistent implementation of crosscutting initiatives (e.g., system security, Section 515, usability and design standards, Section 508). It is also difficult to present a consistent message or branding of the FAA as a whole to external stakeholders.

6.2   Best Practices

Best practices reveal that *four disciplines comprise a successful management framework: the governance model, decision processes, policies and standards, and goals and metrics*[8]. Each of these are included in the governance model proposed below. Private and public sector organizations that are regarded as successful in using the Web for e-Business have mature and flexible governance models. Strong governance models balance the need for shared ownership of Web resources (*federated* governance) and the need to be responsive to business objectives and constituent requirements.

A federated governance model provides for central ownership of enterprise Web resources, while preserving LOB and SO autonomy to use the Web in the service of valid business objectives. It permits responsiveness to a broad group of stakeholders, while also delivering agile and effective program management.

Figure 14 presents a proposed model for federated governance of the FAA Web environment.

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[8] Net Ready, Strategies for Success in the E-conomy, Amir Hartman & John Sifonis with John Kador, MacGraw Hill, 2000
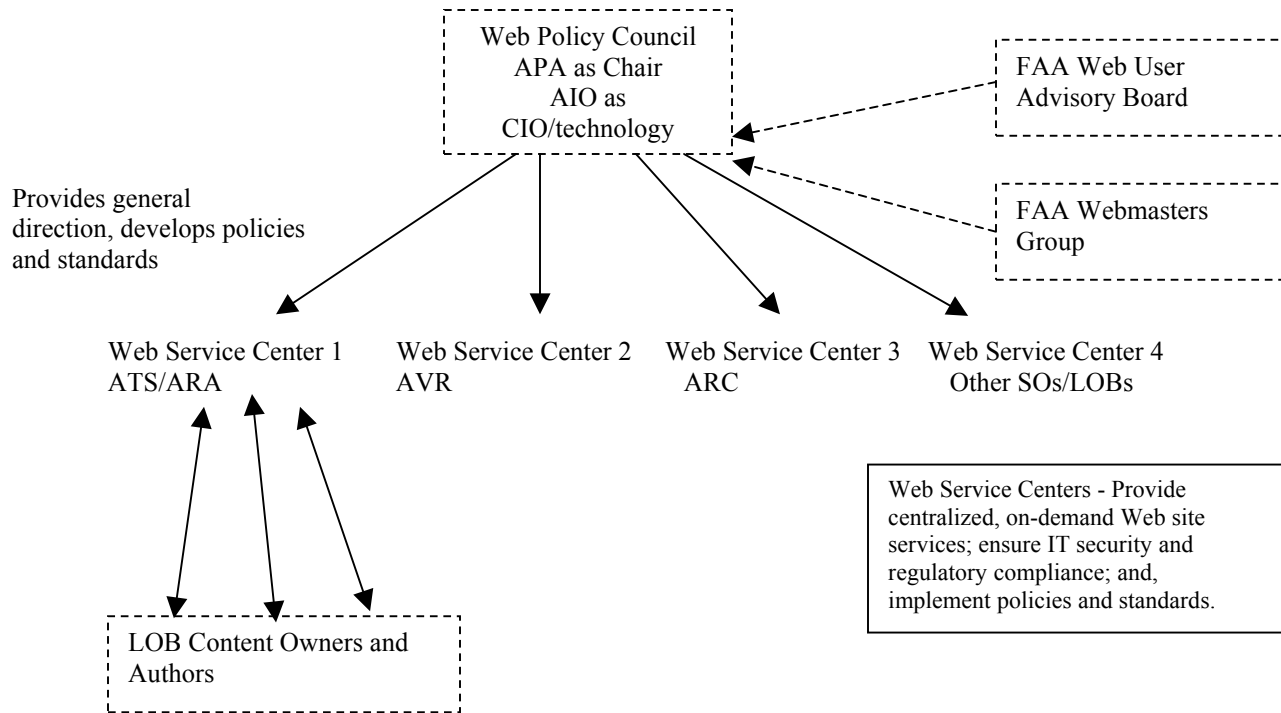
Figure 14 - A Federated Model of Web Governance

Figure 14 depicts the **FAA Web Policy Council** as this central governance. The Web Policy Council and APA would continue their role in providing existing controls and standards. The Council is a means for each LOB and SO to participate in Web governance since they all have a role in the management of the FAA's Web. Two other bodies serve in an advisory capacity, with ad hoc representative membership. An FAA **Web User Advisory Board** would be comprised of non-technical senior-level members who would provide user feedback. An **FAA Webmasters Group**, comprised of Webmasters from the LOB/SO communities, would provide insights regarding emerging technology as well as spotlight FAA Web infrastructure needs (e.g., new broadband requirements, server redundancy needs).

In this model, the development and management of content would continue to remain in the hands of the applicable FAA organization that owns the content. Web content owners would interface with their centralized LOB/SO Webmaster group.

Improved governance is also attained through **Web Service Centers**, since *design standards, security procedures, and regulatory compliance can be enforced through the Centers*, facilitated by a CMS. A federated model provides opportunities for resource savings, since Web staff, hardware, and software can be consolidated into a few Web Service Centers. These Web Service Centers would provide Web technology and infrastructure support: Web site development and hosting on consolidated servers, management of hardware and software, and support for regulatory, statutory, and standards compliance by FAA content owners. System security practices, including the application of IT security patches and ensuring a high level of IT security skills would be more easily ensured.

An LOB would manage each Web Service Center. One potential organization alignment is shown on the figure above where the Web Service Centers are managed and staffed by the Offices of Air Traffic Services (ATS)/Research and Acquisitions (ARA), Regulation and Certification (AVR), Region and Center Operations (ARC), and other staff organizations. The location of these centers would best be distributed geographically in order to foster better overall performance and end user response time. Another option is to have three Web Service Centers: ATS/ARA in Atlantic City, New Jersey, ARC in Oklahoma City, and all other organizations (including AVR and staff offices) from Washington, DC.

This model would also foster the development of technical expertise in each of the Web Service Centers and reduce the size of skilled Web staff required to maintain the same number of Web sites. This approach adheres to the FAA culture of empowering major LOBs through degrees of autonomy and flexibility.

The three or four Web Service Centers can provide backup and recovery capability to each other in the event of short or long term disruptions. It will also be useful to have Web caching servers at the other IAPs in order to optimize end use response time in accessing FAA Web resources. In this way, some IAPs (most likely three) will be Web Service Centers and others will have Web caching capability.

6.3   Alternative: Centralized Approach

An alternative to the federated model is a complete consolidation of the FAA's Web infrastructure support into one Web service center. All Webmaster functions, Web servers, and Web system software would be in one location supported by a backup/failover location. Content authoring and ownership would remain in the LOBs/SOs. In this scenario, the Web Policy Council would continue as an interoffice forum that guides and approves centralized standards and controls, thus giving the FAA organizations input into how the consolidated Web support center operates.

6.4   Alternative: IAPs and Regions

Another alternative is to have Web Service Centers at the eight IAPs with web mirroring capabilities at the remaining regions that are not IAPs. All Webmaster functions, Web servers, and Web system software would be in the eight Web Service Centers, located near or at the IAPs. Each Web Service Center would have a backup/failover location (such as another Web Service Center). Content authoring and ownership would remain in the LOBs/SOs. In this scenario, the regions without an IAP would only have a Web cache server(s) for providing more rapid, local access to FAA Web content, improving end user response time.

6.5   Alternative: Status Quo

Another alternative is to stay with the status quo. The advantages here are that local management can set local priorities for Web development and maintenance to correlate with their organization's current priorities. Resources will also be managed in that context. There

would be no dependence on the Web service center to have resources available or to deliver timely performance; it avoids a risk of insufficient tools or funding at the Web service centers.

6.6 Management Requirements

Management requirements include that the FAA's Web presence shall:

6.6.1 <u>Be guided by an enterprise strategy and business case</u> for the FAA's Web resources and the manner in which they will support FAA business objectives. This business case will prioritize Web development and integration activities and will shape enterprise investment in developing agency Web resources.

6.6.2 <u>Be managed according to a governance structure</u> that provides for LOB and SO participation in the management of FAA Web resources through the Web Policy Council. The governance structure will define specific roles for executive sponsorship, program direction, advisory groups, a program management office, and related aspects so that LOBs and SOs have clearly defined levels of responsibility, control, and accountability for the FAA's Web resources.

6.6.3 <u>Be guided by comprehensive Web metrics</u>. These metrics show how constituents are responding to Web service delivery and how agency Web resources are generating value.

6.6.4 <u>Operate under a set of clear and enforceable policies and standards</u> for FAA Web resources including security. These policies will determine standards and requirements for FAA Web resources, systems security, standards of quality for content published to the Web, standards and guidelines for Web page design and usability, etc. These policies will also define processes for evaluating and testing Web sites and applications proposed for FAA use and for registering and naming all LOB and SO information assets on the Web.

6.6.5 <u>Operate under a clear plan for the maintenance and operation</u> of the FAA's Web resources. This plan will define roles and authority for day-to-day continuity of operations and will specify service level agreements between the operations organization and the agency program management office.

6.6.6 <u>Operate via a clear plan for securing and allocating funding and for managing the capital investment process required over the life of the FAA Web program</u> (in concert with the strategy and business case). This includes complying with OMB-related requirements for IT-related investments and for complying with E-Government provisions.

6.6.7 <u>Comply with all Internet-related Federal laws, regulations and guidelines as well as with FAA policy and standards for Web design and usability and information system security requirements</u>. These include the Federal Records Act, Section 508, Section 515 (Information Quality), the Privacy Act, OMB Privacy guidelines, COPPA, and the Plain Language initiative.

6.7 Outsourcing Opportunities

Opportunities to use outsourcing for FAA Web site management exist to varying degrees in each of the governance approaches described above. Contractor-based Web staff may be better able to maintain currency with technology. However, they will lack familiarity with the needs of FAA stakeholders, aviation, and the business of the FAA. This makes it difficult to optimize the usability of the Web environment without government staff involvement, undercutting potential savings from contracting out. Usability is significantly related to knowledge of the business domain (in this case, the FAA and aviation transportation). Whether contracting out consolidated Web capabilities would reap further benefits would require further study.

The benefits of outsourcing should not be confused with those from consolidation. Consolidation, by itself, is expected to reap benefits.

Chapter 7   Recommendations

Based on the CONOPs, the following are major near term directions recommended.

7.1   Major Near Term Process Recommendations

7.1.1   Develop business cases. This recommendation includes additional planning to solicit greater LOB/SO involvement in this Web planning and would set priorities on targets of opportunity that produce value more quickly, tangibly, and in an orderly manner. The business cases will justify the business benefit, payback, or return on investment (ROI) from long-term opportunities for using the FAA's Web presence for transformational opportunities defined in our long-term CONOPs.

7.1.2   Develop a high-level implementation plan or roadmap. This includes baselining this document and obtaining LOB/SO support for its recommendations. It includes briefings to appropriate stakeholders. LOB and SO input may be reflected in revisions to this document and/or implementation plans. The latter is a way to specify how the Web presence will be built over time; it describes releases of capability over time.

7.1.3   Improve Web/E-Government governance structure. This includes the governance changes identified in the management requirements section.

7.1.4   Develop performance metrics.

7.1.4.a   Performance driven - The Web resource needs to be performance driven. Part of governing that resource involves monitoring and taking corrective measures based on performance metrics. Types of performance metrics include updating frequency, costs, benefits, business impact, customer satisfaction, rate of abandonment, number of hits, flow of traffic, etc.

7.1.4.b   Capture benefits - Collect data and periodically assess the cost and benefit of the FAA Web presence in order to target future investments and trim back on functionality that is not cost effective. Since the Web arena is subject to pursuit of technology for the sake of technology (without regard to a clear business case), having an ongoing collection of cost and benefit data can be a useful way to manage Web investments.

7.1.5   Limit organizational authority. It should be emphasized that the authority to publish a Web page or site needs to be accompanied by the responsibility to keep content up-to-date, maintain information quality (Section 515), and support security and privacy policies. Organizational authority to publish Web sites and pages needs to be limited to those organizations willing and able to meet these responsibilities. Proliferation of such authority hinders FAA efforts to provide a consistent useful message to its customers, meet regulatory requirements, and provide a high level of overall quality in our Web presence.

7.1.6 Develop a funding plan for the federated Web centers and other Web functions. This includes sharing the cost of the federated Web centers among the FAA organizations using those centers[9]. This recognizes the Web as a corporate investment.

7.1.7 Establish a Web policy. Many Federal agencies have a Web policy. The FAA has a brief notice. The development and implementation of a Web policy will define responsibilities (for publishing, oversight, security, validation/testing, resources, and registration) and enumerated guidelines and standards to be used. The policy should foster the management and use of the Web resources as an enterprise asset, helping to drive content and services from business plans and objectives.

7.1.7.a Validation and testing can include establishing processes for one or more "Web publications group that processes everything before it goes up on the Web site. That group should include people who check for and can help content developers with various aspects of making sure a document is ready for the Web. This requires different people in the group who specialize in metatags, plain language, and conformance to design standards." [10]

7.1.7.b Naming conventions can be specified to support system administration and security functions.

7.1.8 Develop a marketing strategy for the FAA Web presence. This should include branding.

7.1.9 Manage risks - Multiple stakeholders and the lack of a single organizational authority make the Web undertaking inherently complex and subject to risks. A solid governance structure provides a level of risk management. Appropriate system security risk assessments are also expected to be useful in managing system risks.

7.2 Major Product-Oriented Recommendations

7.2.1 Consolidate Web resources – servers and staff – into federated Web centers.

7.2.2 While complete centralization is not a fit for the FAA, there is a need to centralize Web functions within federated sites in order to consolidate resources and follow standards in our Web environment. This is consistent with industry best practices. It involves moving Web servers and staff to a selected number of Web centers in order to attain economies of scale, manage and nurture specialized staff skill sets, be better able to implement Web policies and standards, and be positioned for surges in demand on our Web resources. This includes reducing the number of Web pages, Web servers, and Web system administrators. The Web Service Centers would support a designated list of FAA organizations. Each FAA organization would retain content authoring and ownership. They would have some leeway in the design of

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[9] The Visitor-Centric Website, Alan B. Curtis and SherriJoyce King (MemberWare Technologies Inc.), Not dated, pg. 11.

[10] Usability Test Report (for FAA), June 2002, pg.7.

its Web pages while following agreed upon FAA-wide practices and standards and using the Web center for implementation capabilities. A cost sharing arrangement will be needed to finance the Web center activities. The Web Policy Council would continue to be a means for FAA LOBs and SOs to participate in Web policy development.

Several opportunities exist to reduce the overall number of FAA Internet Web pages. These include:

- During conversion efforts of LOB/SO Web pages to comply with a prescribed template for a similar look and feel of the agency's Web sites, a general review for continued relevancy. (During the Federal Web Content Managers' Meeting on October 17, 2002, the Environmental Protection Agency (EPA) noted that their agency has recently achieved a 50% reduction in its static Web pages (from 900,000 to 420,000) during a recent conversion process to a "one look and feel" template ("one agency/one voice"). The EPA's Web site owners were ordered not to merely convert existing pages, but rather to analyze pages for continued relevance and currency.)
- During a review to ensure regulatory compliance: non-compliant pages or those for which compliance will require a prolonged effort might be taken off the FAA Web site.
- During a review to ensure information made public does not put the agency or its resources at risk – in line with publishing content guidelines (e.g., similar to those published by NASA and which have been provided to the Web Policy Council at their request).

Prototype and select, comprehensively implement and train staff in a corporate CMS. The benefits of a CMS are that it will ensure a common look and feel and will enforce many of our usability and design standards. This will reduce duplicative information, provide for data sharing/re-use, and provide a reliable method for managing Web site content, resources, and graphic user interface (GUI).

The FAA has developed a custom-built CMS but it is not fully implemented across the FAA. The agency should examine whether it is more cost-effective to use a commercial-off-the-shelf (COTS) CMS rather than continuing to invest in its existing custom-built CMS. Costs of COTS CMS are roughly $200K for any integration. This compares with the current estimate of $400K to upgrade the existing custom-built CMS. Best practices organizations are using COTS solutions.

The Gartner Group states that organizations need a structured evaluation methodology when selecting a CMS and recommends a rigorous selection process[11]. Criteria for selecting a CMS include the following:

- Author/Acquire Content
  - Collaborating.
  - Automated routing (workflow).
  - Converting formats.
  - Re-purposing.

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[11] Evaluation Framework for Content Management Solutions, Gartner Group, Research Note, June 26, 2002.

- o Indexing (automated and manual).
- o Searching (including full-text).
- o Linking to authoring tools.
- Edit/Group Content
- o Securing.
- o Checking in/checking out (versioning).
- o Linking to authoring/editing tools.
- o Relating content items.
- o Identifying content to be used for multiple distribution channels.
- o Establishing effective/expiration dates.
- Publish Content
- o Dynamic publishing of content and/or pages.
- o Interpreting personalization rules.
- o Converting formats (real time).
- o Enabling e-mail.
- o Integrating print and fax.
- o Streaming audio and video.
- o Tracking usage information.
- Ease of use for the above functions
- Service and support
- Technical Architecture
- Vendor viability
- Cost of purchase and maintenance

It will be useful to test a CMS solution with user representatives from all stages of the content authoring and management processes.

One opportunity is to partner with General Services Administration (GSA)/FirstGov in its effort to acquire a robust CMS. Their goal is to award a contract for a robust, scalable CMS infrastructure for E-Government initiatives and other agencies to leverage in early 2003.

7.2.3 Pursue quick wins and incremental improvements to content including content updating where needed, GPEA transactions, an improved search capability, and a further improved home page (reduced clutter). This would include identified quick wins.

The following are potential quick wins for our Web presence:

- Define a standard set of Web tools.
- Improved search capability – the FAA should explore taking advantage of the GSA/FirstGov offer for this shared service (see: http://www.firstgov.gov/FGSearchService/DisclaimerForm.jsp).
- Enforcing existing standards.

The following are other directions and objectives that need to be considered as we go forward:

- Provide training to the identified FAA Web community to ensure skills are maintained at the required level.
- Evaluate technology for appropriate inclusion in the FAA's Web infrastructure solutions rather than for technology's sake (stay on the leading edge rather than the bleeding edge).
- Examine the need for non-English language Web initiatives to address the Administration's emerging Web initiatives.
- Balance the tension between dumbing-down a Web page versus information-rich content on a Web page.

7.3 Risk Management

The risks associated with this effort can be categorized into three areas: change management, resources, and technology.

7.3.1 <u>Change Management</u>. In recognition of the Internet's power as a communications tool, the FAA has been creating publicly accessible Web sites for several years. During that time, individual LOBs have developed independent processes for developing and publishing Web sites. A move to a more centralized, federated approach to Web management is a significant change and may lead resistance to change at various levels.

Risk	Steps to Mitigate Risk
Need to produce a sustainable target architecture or model that is buildable over time in a phased manner	Strategically, phased roll out of a Web management model which capitalizes on existing LOB best practices
Lack of support at all levels for the initiative to attain this Web architecture; proposed target model conflicts with existing, organizational structures and numerous Web services contracts	FAA Administrator, together with APA and AIO, endorse effort and communicate purpose; conduct customer forums to gain understanding of customers needs
Lack of understanding of the number of people currently performing Web functions (existence of a shadow workforce)	Survey to better define the resource requirements for FAA's Web presence
Need to ensure customer satisfaction	Develop and monitor customer satisfaction metrics
Emerging agency Web governance model	Develop agency-level Web governance model

Table 1 - Risks Associated with Change Management

7.3.2 <u>Resources</u>. Although a federated Web Management Model results in long-term savings to the agency, the path to migrate to this model from the current decentralized state requires significant resources. It is important that these resource requirements are identified throughout the implementation of this model.

Risk	Steps to Mitigate Risk
Funding issues – limited resources and timing; cost of federated Web centers being shared by using organizations	Develop a budget for FY03 through FY04; use phased rollout to adjust to funding limitations; establish a funding plan for the proposed Web

	centers
Multiple timelines of existing LOB/SO Web services contracts	Identify costs and timelines of existing LOB/SO contracts; optimize use of existing contracts to meet project goals
Limited full time equivalent (FTE) resources	Conduct survey to identify the number of FTEs required to meet desired final state; phased rollout to adjust to FTE limitations
Desire of many to revise FAA Web presence quickly	Phased rollout to adjust to resource limitations

Table 2 - Risks Associated with Resources

7.3.3   Technology. There are a variety of risks associated with technology that threaten the success of this initiative. FAA LOBs/SOs use different technologies to establish and maintain their Web presence. The rapid rate of technological advances in the area of the Web tools and methodologies present additional challenges and associated risks.

Risk	Steps to Mitigate Risk
Need to identify a standard toolset that meets the needs of the customers	Prototype and select a Web toolset based on both customer and system requirements
Compatibility issues (e.g., networks, operating systems, hardware)	Establish centralized Web services standards based on customer and system requirements
Rapidly changing technology	Select tools based on business justification and using established and open standards
Stability of technology vendors	Select technology vendors who have demonstrated financial stability (avoid build-it-here syndrome)
Potential inability to provide a timely single entry point to the FAA Web if there are multiple solutions for PKI and digital certificates across the FAA; there is no cross-certification if there are multiple PKI solutions.	Plan a cohesive set of products to add the requirements across the FAA.

Table 3 - Risks Associated with Technology

Appendix A – Drivers and Current Environment

A.1   Business Drivers. The following is a more detailed description of the drivers as presented in Section 1.3. While the FAA has made a number of improvements to its Web presence over the past two years, the agency continues to face a number of business changes and drivers that in the near and long term will impact its Web site and Web capabilities.

A.1.a   External Drivers

- Citizen Expectations – These are the evolving expectations for improved governmental Web-based services by our public stakeholders. These expectations include ready access to services and a government that is more transparent and accountable (see PMA below).
- Partner Demands – Those external stakeholders of the FAA who have frequent interactions with the agency (e.g., other government and state agencies, airlines, flight schools, aircraft maintenance organizations) expect quality Web-based services.
- Technology Advances – Several emerging technologies offer both opportunities and challenges for the FAA Web environment. These include XML, portal technologies, Web services technologies, Simple Object Access Protocol (SOAP), Universal Description Discovery and Integration (UDDI), and CMSs. It is important that these are evaluated for both short-term and long-term implementation to continually improve the agency's Web presence.
- President's Management Agenda (PMA) – The PMA calls for expanding the use of the Internet to empower citizens. The PMA includes a mandate to deliver high quality citizen-centric services and timely and requested information, foster collaboration across Federal and state agencies, and automate internal processes, thus reducing internal costs. It is important that the FAA examine the management of its Web presence so that it is positioned to deliver true E-Government services and to be a full partner in the emerging cross-government solutions (e.g., e-Grants and e-Procurement).
- Regulatory and Statutory Requirements – These include e-FOIA, Section 508, Section 515, COPPA, and general OMB Privacy Guidelines. It is important to realize that OMB continues to develop Web guidelines and requirements for government agencies.   A new initiative includes potential Web content requirements for Federal agencies.

A.1.b   Internal Drivers

- IT Security – Requirements for IT security in Web environments are endemic to government and industry and it is expected that the protection of our IT infrastructure will remain a critical issue. Each Web server can be viewed as an opening to our IT infrastructure from the external world.   IT security patches and other protective techniques must be applied in a consistent manner and those who serve as system administrators of these Web server systems should be skilled in the latest IT security methodologies. Reducing agency IT security vulnerabilities is proportional to limiting the number of Web servers needed to properly support our Web presence.
- Constrained Budgets – With the many demands facing it, the FAA needs to optimize the use of its resources including those allocated to our Web environment.   Resource savings opportunities through consolidation efforts, agencywide licensing agreements, and other best practices commonly used across government and industry will be examined.

- NAS Modernization – The FAA has numerous commitments to achieve modernization of the NAS. These involve new systems for controllers, radar, weather, and navigation. Many of these systems have G2B and limited G2C implications under E-Government.
- Evolving Governance Practices – As mentioned earlier, the FAA established a Web Policy Council and, more recently, gave APA the lead role in Web management. As the FAA's Web governance evolves, any new or changing governance practices will impact our Web environment. This report identifies Web management practices, which can overcome communication barriers and ensure access to information that is consistent and not duplicated.
- Administrative Systems Modernization – The FAA is implementing Delphi as its new financial management system (a DOTwide system) and is pursuing other administrative system modernization initiatives that have G2E and G2G implications.
- Workforce Issues - IT is an enabling technology that affects every aspect of business as well as the way the government conducts business. This fact is demonstrated by the current focus on E-Government and Web services, the continuing emergence of new technologies and applications and new ways of using information, i.e., knowledge management.   However, several reports, including two issued by the Department of Commerce, have identified two related issues that will impact the government IT workforce: (1) by 2008 the United States will need over 2 million new skilled core IT workers; and (2) there is a lack of sufficient graduates in IT-oriented curricula. Like other Federal agencies, the FAA has an aging workforce.   This threat of a lack of skilled IT workers adds to the importance of leveraging our IT assets to ensure that the FAA can deliver the required level of services to its customers and stakeholders. The FAA's Web presence is a key orientation tool for new employees and contractors to be able to contribute rapidly to the FAA's functions.

A.2   Current FAA Web Environment.   Government organizations recognize that there is high constituent interest in receiving quality information from government agencies via the Web. This coincides with OMB's emphasis on E-Government[12]. Quality Web capabilities could be a means of business transformation, resulting in improved ROI, reduced manual inquiries, increased constituent confidence in the government agency, and helping customers to make better decisions.

At the same time, Internet capabilities are a key tool to have the "right information at the right time to make the right decisions." The informational resources on the Web could be useful to FAA employees analyzing a problem to find cost-effective solutions. Web resources permit the sharing of knowledge and information that will contribute not only to near term problem resolution but also to long-term human capital development.[13]

A.2.a   Web Site and Architecture Observations

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[12] A recent Arthur Andersen study states, "Government organizations provide incredibly useful information to constituents", A Usability Study of Selected Federal Government Web Sites, Andersen/Office of Government Services, February 2002, pg. 1.

[13] "Optimization of Information to Improve Decision-Making in Government: The Information Value Chain" (briefing),
IBM Institute for Business Value, November 2002.

As stated in an Andersen study of Federal Web sites:

> "Federal Web sites have evolved over the past six or seven years in a piecemeal fashion with each department, division, or working group responsible for creating its own Web presence . . . The result of this "internal" focus: site structures are based on organization charts rather than user needs, and sites exhibit a hodgepodge of navigation, layout, content, and branding approaches. At best this leads to sites that are slightly difficult to navigate; at worst to sites that confuse, frustrate, and alienate users."[14]

The FAA's Web Usability Study echoes this observation: "Many Web sites have grown by accretion – and their home pages have then become a mass of uncoordinated links."[15] The Web Policy Council has sought, over the past year, to address the problems identified above with a number of improvements to its Web environment. The Council's content standards (http://intranet.faa.gov/webrules/docs/FAA_WEB_STANDARDS_10_10_02.pdf) include the following statement:

"FAA's Web site is its primary face to the public. It is a major means by which we provide service to our customers. FAA's Web products should:
- Incorporate a similar "look and feel," to enhance the image of "one FAA".
- Convey a clear message about FAA's mission and activities.
- Support mission-related activities of FAA.
- Be consistent with prudent operational and security considerations.
- Provide the public with easy electronic access to information about their
government."[16]

The current FAA home page has a contemporary look, particularly as compared to other Federal agencies at this date. The home page itself is customer-centric and has only one button for the "FAA Organizations". The upper left side offers pages customized to various categories of our external Web users (e.g., airline operators, airport operators, pilots and aircraft owners). This is the start of portal-like capabilities. It offers multiple means of finding information including "Ask FAA", Site Map, "How Do I . . ." and the portal-like pages. However, the home page is often viewed as cluttered because it has many options that a user can select. The search capability is consistently criticized for not leading to what the user wants to find. The FAA Internet has some interactive capabilities including: the ability to query the aircraft registry database; view the current status of an airport (delays currently being experienced); runway visibility; and the ability to download virtually all FAA forms relevant to our external stakeholders. Therefore, it can be said that the FAA's Web presence includes not only static content but also some interactive capabilities. However, online transaction processing is largely limited to www.diy.dot.gov (a DOT site developed and maintained by the FAA's Aeronautical Center) and our procurement organization. The FAA Internet has some collaboration

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[14] A Usability Study of Selected Federal Government Web Sites, Andersen/Office of Government Services, February 2002, pg. 14.

[15] Usability Test Report (for FAA), June 2002, pg. 4.

[16] Appendix B: Content Requirements: FAA Web Site, 2002, pg. 1.

capabilities such as those available from the Collaborative Data Integration Management System Web site (https://callisto.cdims.act.faa.gov/).

As one moves past the home page to the lower level pages of the FAA Web presence, one can find Web pages that have negative attributes, including:

- Not using the design and usability standards.
- Being organizationally centric rather than customer-centric.
- Navigation difficulties.

Virtually all FAA organizations have an Internet presence, including all LOBs and SOs as well as all regions, centers, Flight Standards District Office, and Flight Service Stations. In a positive development, ATS recently required tower Web pages to be closed. A partial list of these sites is as follows:

FAA Regional Offices and Centers:

- Alaskan Region
- Central Region
- Eastern Region
- Great Lakes Region
- New England Region
- Northwest Mountain Region
- Southern Region
- Southwest Region
- Western Pacific Region
- Mike Monroney Aeronautical Center
- William J. Hughes Technical Center
- Center for Management Development

Air Route Traffic Control Centers (ARTCC):

- Cleveland, Ohio ARTCC
- Denver, Colorado ARTCC
- Minneapolis, Minnesota ARTCC
- Fort Worth, Texas ARTCC

Automated Flight Service Stations (AFSS):

- Albuquerque, New Mexico AFSS
- Altoona, Pennsylvania AFSS
- Anniston, Alabama AFSS
- Bridgeport, Connecticut AFSS
- Buffalo, New York AFSS
- Dayton, Ohio AFSS
- Elkins, West Virginia AFSS
- Fairbanks, Alaska AFSS
- Fort Dodge, Iowa AFSS
- Fort Worth, Texas AFSS
- Gainesville, Florida AFSS

- Grand Forks, North Dakota AFSS
- Hawthorne, California AFSS
- Jackson, Tennessee AFSS
- Kankakee AFSS
- Lansing, Michigan AFSS
- Leesburg, Virginia AFSS
- Macon, Georgia AFSS
- McMinnville, Oregon AFSS
- Nashville, Tennessee AFSS
- Raleigh-Durham, North Carolina AFSS
- St. Petersburg, Florida AFSS
- Wichita, Kansas AFSS
- Williamsport, Pennsylvania AFSS

Automated International Flight Service Stations (AIFSS):

- Oakland, California AIFSS
- Miami, Florida AIFSS
- Kenai, Alaska AIFSS

Terminal Radar Approach Control (TRACON) Facilities:

- Grant County, Washington ATCT/TRACON
- Houston, Texas Intercontinental ATCT/TRACON
- Orlando, FL International ATCT/TRACON (MCO)
- Pittsburgh, Pennsylvania ATCT/TRACON
- Potomac TRACON
- San Francisco/Oakland Bay TRACON

A.2.b   Physical Characteristics

Currently, the FAA has many tens of thousands of Web pages that are spread out throughout multiple organizations. More specifically, at FAA headquarters alone, a February 2002 count revealed the existence of 20,000 Web pages and related items.[17]   Each FAA organization involved in Web site development and maintenance has one or more servers for these functions. The FAA's Web presence includes multiple divisions at each region and center as well as many organizations at headquarters. Geographically, the FAA has Web resources dispersed across the regions, centers, and headquarters including staff (Web administrators), hardware, and software. Contractor support is also employed at these various locations. The headquarters demilitarized zone (DMZ) and a few regions (includes HQ IAP, ATS IAP, ARC IAP, Western-Pacific Region (AWP), and Great Lakes Region (AGL)) had about 136 Web servers as of February 2002.[18] Another region has about 30 Internet and Intranet Web servers and seven Web Administrators.[19] Extrapolating this figure across the nine regions, two centers, and headquarters suggests that more than 300 Web servers and 100 Web administrators support the FAA's Web presence.

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[17] Source: AIS-300 staff; does not include files such as Portable Document Format (PDF), video, sound, Microsoft Word, spreadsheets.

[18] Source: AIS-300 staff; based on a count of IP addresses which can lead to some redundant counting when a server has more than one Network Interface Card (NIC) (and more than one IP address).

[19] October 2002

Because of the decentralized control of Web resources, there are a variety of hardware platforms and software applications and tools in use for Web development and maintenance.

A.2.c   Branding

Over the past year, the FAA Web Policy Council has emphasized the importance of a consistent use of the FAA logo on FAA Web pages and has incorporated this stand in their Web standards. Although the FAA home page now communicates the ownership of the Web site better than previously, even Web sites "1 click" from the home page do not consistently employ the logo and could confuse a customer regarding what agency's information they were accessing. The improved FAA home page better communicates its purpose by targeting our customers (in a customer centric manner). The home page uses an image of an aircraft in the upper left corner and there is an aviation photo in the content section – thus communicating the aviation domain of the Web site. However, further branding is necessary to ensure that users recognize the FAA ownership of the Web site, according to the FAA Usability Test Report.

Another part of branding involves using an organization's Web presence to affect how the FAA wants to be viewed by its stakeholders.   The FAA does use some consistent messages in its plans and external communications, e.g., by placing an emphasis on aviation safety; service delivery; overall efficiency of the NAS ("system efficiency" in the sense of efficient air traffic control and management); regulation; and certification. The FAA home page communicates these kinds of messages and provides specific support to customers through its "Traveler Briefing," "How Do I …?" and "Ask FAA" sections. Also, the "Information for" section to the left is aimed at particular classes of Web site visitors such as airline and airport operators, FAA employees, mechanics, and travelers (although the Usability Test Report indicated that many site visitors do not notice this section).

A.2.d   Navigation

There is some attention to "information hierarchy" in the home page by presenting alerts and latest news as well as in the overall structure of the home page. Furthermore, the Web Policy Council now controls what will be posted to the FAA home page. Recent FAA Web improvement activities from the Web Policy Council have focused on the FAA home page and the pages that are "1 click" from it.

A.2.e   Content

Like most government Web sites, the FAA has an emphasis on providing information through its Web site. Thus far, it has only limited transaction-oriented capabilities, as required by E-Government and GPEA. More complex E-Government capabilities, such as interactive forms and applications that enable financial transactions, remain limited on the agency's Web site. However, the FAA has some interactive forms on http://www.faa.gov/forms/index.html and has plans for more interactive forms. In addition, our constituents can use DIY.DOT.GOV to perform some financial transactions. In terms of providing access to interactive databases, the online access to the NASDAC is an example where users can browse and query aviation safety data from a variety of systems.   Both NASDAC and the forms Web page are immediately

accessible off the FAA home page. The airman and aircraft databases are also available for query online.

A.3   Customers

Figure 15 illustrates some of the FAA's customers.

CATEGORY	CUSTOMER TYPE
G2B	Airlines
	Flight schools
	Aircraft maintenance organizations/corporations
	Aircraft manufacturers
G2C	Flying public
	Pilots
G2G	OMB
	NTSB
	DoD
	BTS
	TSA
	NASA
	Airport authorities
	ICAO
	Other civil aviation authorities internationally
G2E	FAA employees

Figure 15 - FAA's Online Customers

G2B – Government-to-Businesses
G2C – Government-to-Citizens
G2G – Government-to-Government
G2E – Government-to-Employees

A.4   Current Web Visits

Figure 16 contains a list of the FAA Web sites with more than 5000 hits during the period of September 2 through September 13, 2002. However, it should be noted that "hits" cannot be directly correlated with usability and functionality.

**Rank	URL Text Name	URL Address	# of Visits	
FAA.gov Home Page Links visits Statistics for September 2 - September 13, 2002
		*Ranking based upon faa.gov top 200 pages		
1	FAA Home Page	www.faa.gov	225,384	
2	Search	www.faa.gov/search	32,670	
3	Preliminary Accident Data	www.faa.gov/avr/aai/iirform.htm	24,896	
4	Rulemaking	www.faa.gov/avr/arm	14,153	
12	Aircraft	www.faa.gov/certification/aircraft/air_index.htm	11,316	
14	FAA Employess	www.faa.gov/ahr	10,525	
16	Site Map	www.faa.gov/sitemap	9,972	
18	Advisory Circulars	www.faa.gov/regulatoryadvisory/ac_index.htm	8,556	
24	People	www.faa.gov/certification/people.htm	7,275	
22	ASK FAA	www.faa.gov/apa/pi1main.htm	7,647	
26	How Do I	www.faa.gov/howdoI	6,910	
7	NOTAMS	www.faa.gov/ntap	12,072	
34	A Safety Violation	www.faa.gov/apa/traveler	5,602	
34	Traveler Info	www.faa.gov/apa/traveler	5,602	
30	General Aviation	www.faa.gov/avr/afs/infoforgeneralaviation	5,873	
37	A Pilot	www.faa.gov/avr/afs/pilothowdo.htm	5,381	
39	Federal Aviation Regulations	www.faa.gov/avr/afs/fars/far_idx.htm	5,271	
43	Air Traffic Controller	www.faa.gov/careers/employment/atc.htm	4,903	
36	Accident Investigation	www.faa.gov/avr/aai/aaihome.htm	5,386	
31	Pilots & Aircraft Owners	www.faa.gov/avr/afs/infoforpilotowner	5,803	
38	Regulatory Advisory	www.faa.gov/regulatoryadvisory/	5,377	
41	About the FAA	www.faa.gov/apa/newsroom	5,170	

Figure 16 - FAA Web Site Statistics for September 2 through September 13, 2002

(Note that missing ranking numbers represent pages that are not on the FAA home page.)

Appendix B – Best Practices

This requirements and architecture strategy drew upon a variety of research, including best practices in industry and government. Key sources of information included Giga, the Corporate Executive Board, and other references (Appendix F). The work also drew on expertise from IBM Business Consulting Services and course material from the IRM College (National Defense University) course, "Strategic Management of Web Sites." This Appendix identifies best practices and lessons learned as well as opportunities for leveraging these across the Agency.

B.1   Federal Agencies with a Leading Web Presence

A recent study identified the following Federal agencies as having a leading Web presence[20]:

- U.S. Patent and Trademark Office.
- Department of Health and Human Services.
- Department of Education.
- Department of the Treasury.
- Department of the Navy.

This study was based on a rating of 148 Federal Web sites along the following areas: site services provided online; quality of user help features; quality of services navigation; site legitimacy; and accessibility. Note that the EPA and the Department of Energy have also received Web-related awards.

B.2   Giga Scorecard of DOT Web Sites

In September 2001, Giga analyzed five DOT Web sites (home pages and related pages)[21]: FAA, Bureau of Transportation Statistics, National Highway Traffic Safety Administration, DOT and Research and Special Program Administration. The analysis of the FAA Web site focused on the current FAA (blue) home page (Appendix G). In the areas analyzed, the FAA scores were:

- Marketing (Branding) – Low against the other four peers and substantially low against a composite best practice score.
- Use of Technology – Above its peers and comparable to a best practice composite score.
- Transaction – Low relative to its peers and substantially below best practice.
- Customer Support – Similar to its peers but substantially low compared to best practice.
- General Information – Medium grade, similar to its peers, but below best practice.
- Site Usability – "Better than its peers and near best practice!"

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[20] The State of Federal Web Sites: The Pursuit of Excellence, Genie Stowers, San Francisco State University, Supported by the PricewaterhouseCoopers Foundation for the Business of Government; August 2002.

[21] Web Site ScoreCard™ Assessment for the US Department of Transportation, Giga Information Group, September 2001.

- Home Page Usability – Better than its peers and not far from best practice!

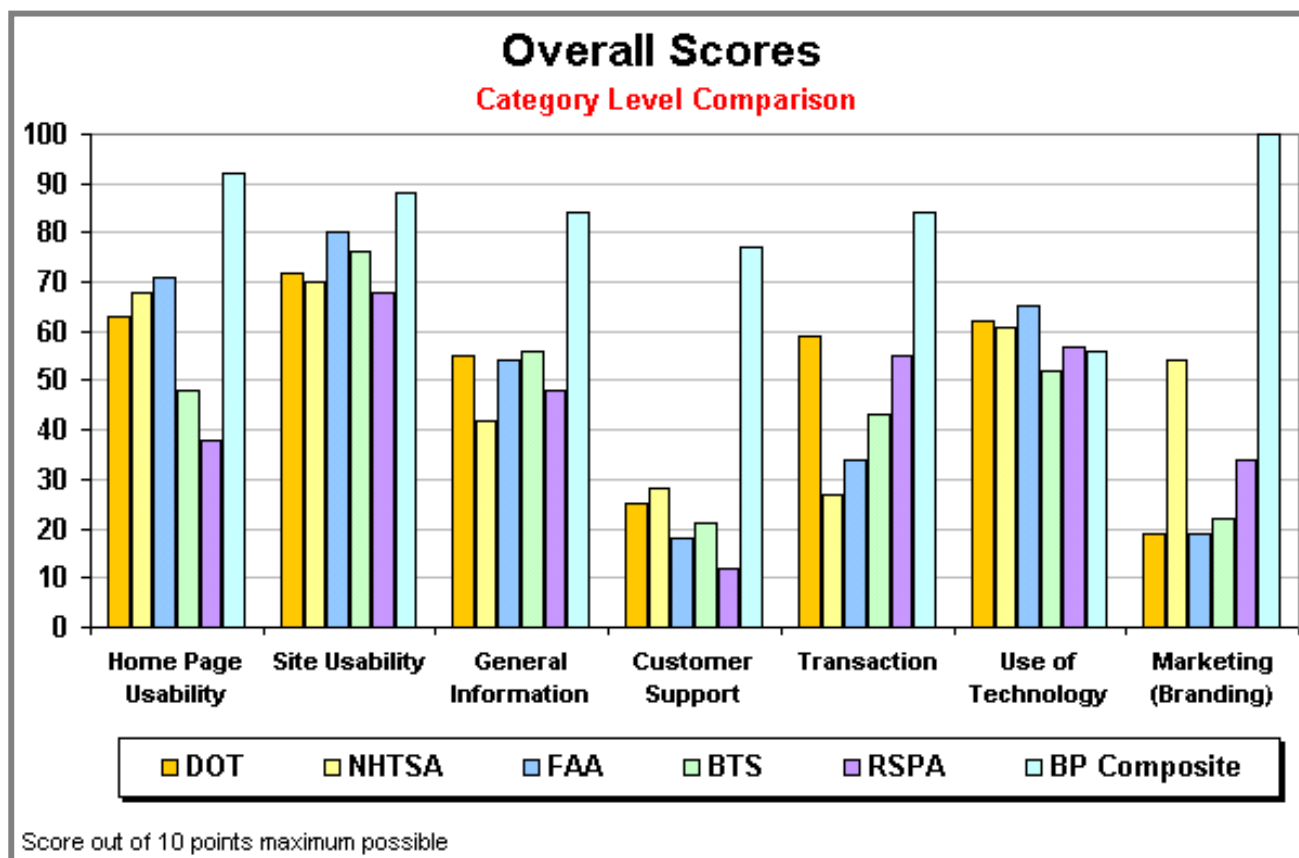Figure 17 presents the scores. The FAA is third from the left in each set of bars.

Figure 17 - Giga Assessment of Five DOT Web Sites
(BP Composite = Best Practice Composite)

B.3   Samples of Best Practice Research

B.3.a   U.S. Patent and Trademark Office

"The U.S. Patent and Trademark Office (http://www.uspto.gov/) ranks as the top Federal Web site in terms of services, user help, navigation, legitimacy, and accessibility. The site provides a vast amount of useful content and a comprehensive set of aids to the user — all designed with the user in mind.

Numerous services are available, including how to complete certain tasks (e.g., how to apply for a patent, http://www.uspto.gov/web/patents/howtopat.htm) and extensive information and resource listings about other aspects of the patent and trademark process. The site contains numerous searchable databases (existing patents and trademarks, published patent applications, patent and trademark applications) and even allows users to apply online for patents and trademarks (through the Electronic Filing System for patents, http://www.uspto.gov/ebc/efs/index.html, and the Trademark Electronic

Application System, http://www.uspto.gov/teas/index.html). Through an e-commerce application, consumers can purchase patent and trademark documents online."

<u>Analysis</u>: Customer-centric Web site.

B.3.b   State of Michigan

"*The State of Michigan reports that consolidating one hundred departmental Web sites into a single portal generates annual cost savings of $3.25 million.*

The State of Michigan launched a Web portal to consolidate one hundred departmental Web sites into a single point-of-access through which citizens can obtain information and services. Prior to launching its Web portal in July 2001, the State of Michigan's online presence was decentralized and disorganized. Approximately one hundred departments operated independent Web sites based on different portal and hosting vendors, resulting in an inefficient and inconsistent patchwork of online information, and forcing citizens to navigate through multiple government agency Web sites to obtain information and services.

State officials report that the portal generated immediate benefits following its July 2001 launch. The centralized portal has encouraged citizens to access government information and services online; traffic to the portal is double what it was for the 100 sites combined. In addition, consolidating with a single hosting service produces cost savings of $2.5 million per year, and automating the process of entering form data submitted by applicants produces additional cost savings of $750,000 per year."

<u>Analysis</u>:
- Consolidation can lead to cost savings.
- Portal provides a single point-of-access for customers.
- Single hosting service produces cost savings.

<u>Sources</u>:
Kontzer, Tony and Eric Chabrow. "Portals Do Their Civic Duty," *InformationWeek*, April 8, 2001.
Conlin, Robert. "Michigan Citizens Get 24/7 E-Gov Access," www.*CRMDaily.com*, July 12, 2001.
Terracino, Jeffrey. "Gov Sites Get It Together," www.*wired.com,* January 17, 2001.
Barlas, Demir. "New Government Portal," *Line56*, July 23, 2001.

B.3.c   U.S. Department of Energy

"*United States Department of Energy Deploys Portal to Consolidate Databases and Promote Knowledge Management; Anticipates Productivity Gains of Five to 10 Percent.*

The Office of Civilian Radioactive Waste Management (OCRWM), a 2,500-FTE office within the U.S. Department of Energy, deployed a portal to consolidate a multitude of information databases and facilitate knowledge management. The OCRWM's legacy repositories contained over one million electronic and paper documents, including 1,500 Lotus Notes databases, thousands of electronic documents in disparate formats, including e-mails, PDF files and Word documents, and data collected from various government

agencies and news organizations. Staff was unable to inventory or locate information, and frequently spent more time searching for data than actually using the information to execute their jobs.

In December 2000, the OCRWM implemented a portal solution to provide a single point of access to all information, and to integrate and organize the internal repositories. Based on a Windows NT platform and software from Autonomy, the portal enables searches across internal and external information repositories and various file formats. Natural-language searching identifies documents containing words that are different than the search term but represent the same idea. For example, if a user enters "hydrology" as a search term, documents discussing "water movement" are captured. Personal agent technology automatically pushes documents and current news to staff members, rather than requiring them to search for it. In addition, the portal informs users of colleagues with matching search interests and hosts discussion forums and chat rooms, thereby improving information sharing and fostering collaboration between geographically dispersed colleagues. The CIO anticipates a five to 10 percent gain in productivity from efficiencies generated by the portal, such as greater collaboration, faster information retrieval time, and greater access to information."

Analysis**:**
- Single point access reiterated.
- Knowledge management incorporation.
- Collaboration from portal functionality produces productivity gains.

Sources:
Caterinniccia, Dan. "Energy Strikes It Rich With Knowledge Portal," *Federal Computer Weekly*, February 5, 2001.
Loftin, Kathy. "OCRWM Information Portal,"
http://cio.doe.gov/aitc/2002/presentations/11aloftin.ppt

B.3.d   United States Air Force

"U.S. Air Force Deploys Portal to Consolidate Hundreds of Intranets and Databases, Reduce Costs and Improve Efficiency.

In late 2001, the U.S. Air Force (USAF) deployed an enterprise-wide portal to consolidate hundreds of intranets and information from hundreds of legacy databases, and to provide personnel with desktop access to information, applications and services via a single point of entry. Named "My.AF.mil" and based on technology from Sytel, Mitre Corp, Broadvision, Plumtree and Verity, the portal allows 1.2 million service personnel to access leave and earnings information, complete medical insurance forms, file tax forms, enter changes of address, locate the e-mail address and phone number of active service personnel, and access computer-based training modules. Authorized users can access combat intelligence and mission support information via the portal. Also used to promote supply chain management, the portal allows aircraft repair personnel to obtain data on parts availability, and access equipment repair manuals, supply management data and inventory management applications. Contractors use the portal to retrieve specifications that assist in the design of new military facilities and equipment. Air Force officials expect the portal initiative to cut costs by eliminating redundancy, and assist

service personnel to work more efficiently. In some instances, the time for users to access information has decreased from days to just seconds."

Analysis**:**
- Single point of entry.
- Personalization.
- Eliminates redundancy.
- More efficient personnel.

Sources:

L. Scott Tillett, Air Force Enlists Portals. *InternetWeek*, November 20, 2001.

Ibid., "Air Force Using BroadVision For Portal," *InternetWeek*, October 24, 2001.

Gannon, Thomas F. "Web-Enabling the Air Force: The Air Force Portal," *www.mitre.org*, published 2001.

"Verity to Power United States Air Force's 'Immensely Complex' New Portal: Air Force Personnel, Families and Contractors to Utilize Verity's Software to Access Critical Information Quickly and Easily on My.AirForce Portal," *www.verity.com*, October 30, 2001.

Dawn S. Onley, "Air Force sets final plans for enterprise portal," *Government Computer News,* September 10, 2001.

"Sytel Inc.: Clients and Partners," *www.sytel.com.*

Appendix C – Intranet Opportunities and Observations

Intranet capabilities are useful for employee research, internal information collaboration and exchange, and employee human resources management. Robust Intranet capabilities can rapidly communicate the results of recent employee research and analysis to other involved organizations. Because the Internet has a global audience, security concerns often make it important to limit access to some information to FAA employees. It is important to note that many corporations today are finding that they can field their Intranet capabilities on the same infrastructure used for the Internet in order to avoid the cost of duplicate infrastructure development and maintenance. (Source: IBM/PWC)

Some of the FAA's current internal informational services include:

- Information about FAA organizations, programs, and projects as well as standards, regulations, forms, and orders.
- FAA employees' employment information.
- PKI capabilities.

Several future innovative uses of technology for the FAA employee community may include:

- Nomadic workplace tools.
- Mobile office technologies (e.g., wireless).
- Collaborative workplace tools (which will facilitate knowledge management goals and objectives).
- e-Learning (includes Webcasting and video streaming technologies).
- e-Forms.
- Utilization of employee self service benefits tools.

An employee portal offers other potential advantages for the FAA. It could foster a holistic agency and provide one location for internal communication (e.g., support for the Administrator's Webcasts to the FAA community). It also could provide the means for communities of interest to capture and share knowledge and lessons learned, thus increasing mission success. It could serve as a launch pad for agency initiatives and Web-based tools as well as a cornerstone for change management communication at the agency level.

Appendix D – Architecture Concepts from Industry and E-Government

The culmination of best practices has produced the conceptual architecture described in this Appendix. Figure 18, based on the E-Government Enterprise Architecture Guidance[22] draft made by the Interagency Federal Enterprise Working Group, shows the specific layers and components of a conceptual architecture.
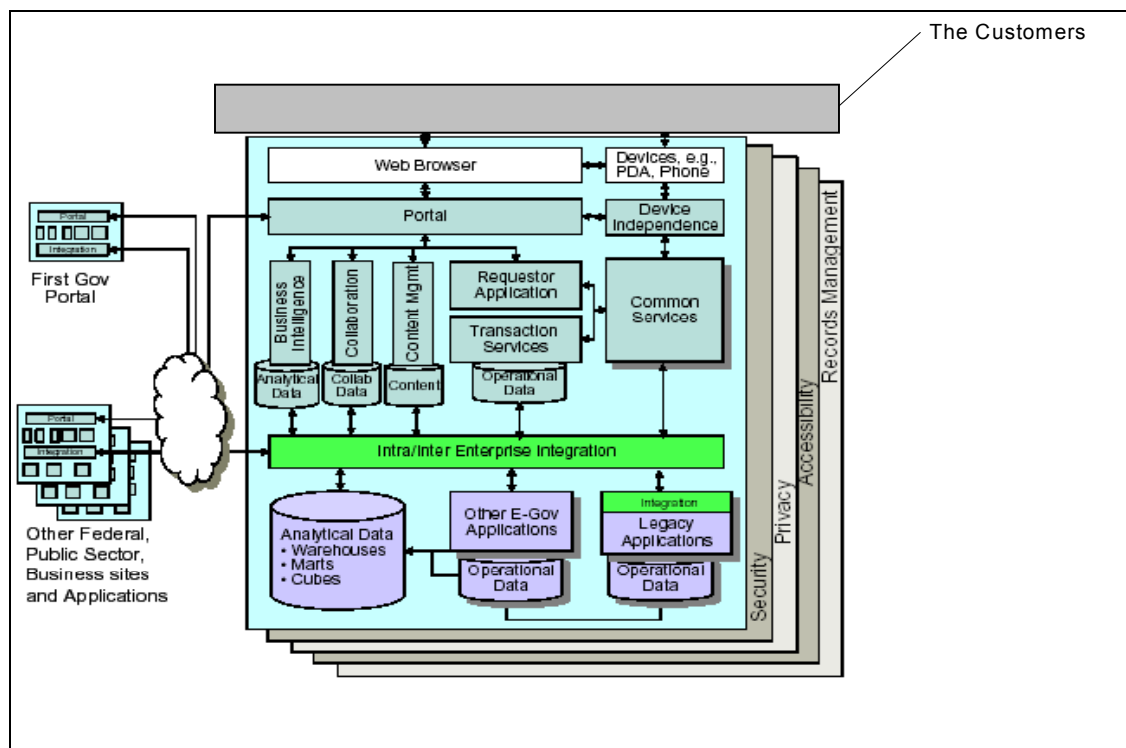
        D.1   The Customers (End Users)

Figure 18 - Conceptual FAA Web Architecture

The most important component of the FAA Web architecture is its customers. It is important to identify the primary audience and target information specifically for that audience. Within this focus on FAA's information customers, privacy and security concerns remain a high priority. Privacy and security policies must be developed and easily accessible from the top level Web site. Web managers and designers need to organize sites for users who may know nothing about the agency or its structure. Robust and varied types of user help and clear navigation aids that direct users to services and specific information should also be included.

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[22] Federal Enterprise Architecture Program Management Office (FEAPMO), E-Government Enterprise Architecture Guidance (Common Reference Model).

The customers, who will drive the FAA Web site content and services can be grouped into categories so that an efficient content delivery, services and personalization can be applied to each category. The experience of the customers or end users of the FAA portal should include:

- Easy to navigate the content based on category of user.
- Response time must meet or exceed the industry standards.
- Ability to search content via simple and advanced search engines.
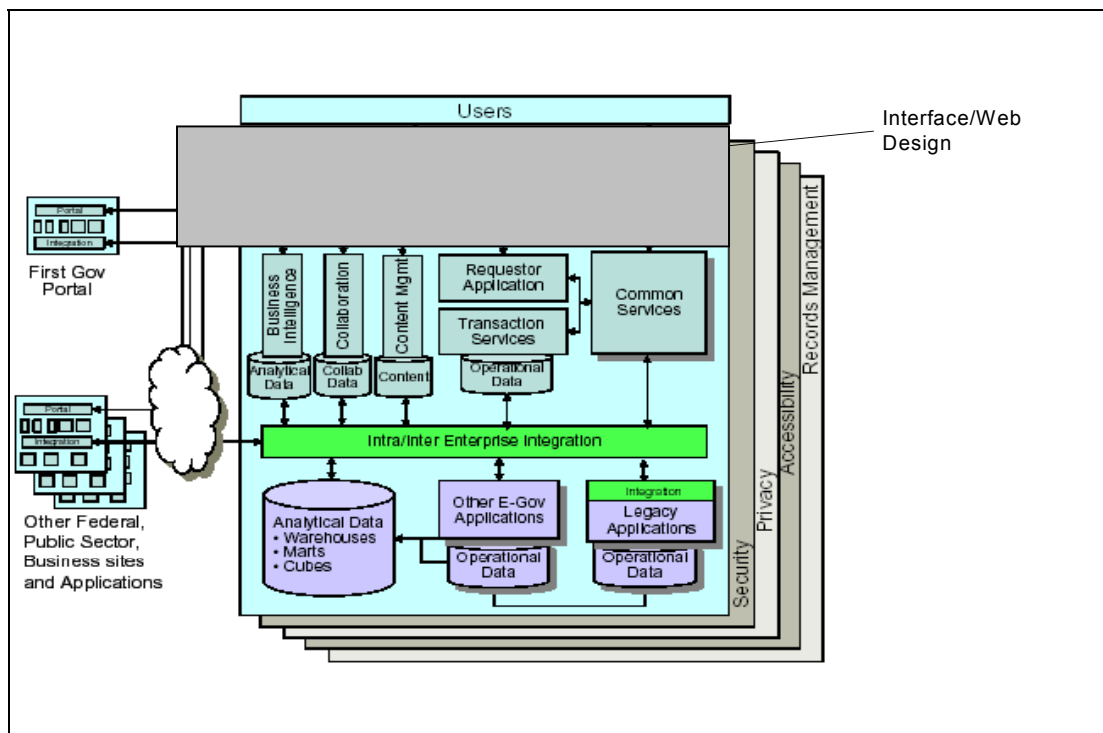- Ensured security and privacy of the user.

D.2   Interface

Figure 19 - Highlighted Interface/Web Design Component

The interface of the Web architecture will be the presentation piece of the FAA's Web site. Accessibility is a high and ongoing priority. A study made by GIGA information group concluded that, despite the mandate to comply with Federal regulations by mid-2001, only 13.5 percent of 148 sites examined had zero errors, and another 21.6 percent had one error. Even among the top rated Web sites, only two had just one error, and the others had more than two. With this in mind, Web designers and Web managers need to give more attention and priority to accessibility issues, including monitoring updates and changes to ensure that all content meets standards and policy. Special attention must also be given to content and services. Private sector Web practices tend to follow a glitz model, which are high on concept, graphics, and animation and low on content and services. Customers from any audience need to be able to find their way directly to the appropriate services on the agency's Web site. The architecture approach should be to rely on the audience and/or service. This will result in a design for outside users, not for

agency insiders. According to multiple research firms, one of the top rated Federal Web sites is the "U.S. Department of the Navy" and, based on usability, accessibility, and legitimacy:

> "Overall, this is a content-rich site, designed to communicate to
> current employees as well as potential recruits, thereby addressing
> numerous constituencies."

D.3   Portal Concepts

The term "portal" is used loosely today. It is generally synonymous with personalization of Web pages and with providing a single gateway for a Web site that is, or proposes to be, a major starting point for users when they get connected to the Web or that users tend to visit as an anchor site. There are general portals (e.g., FirstGov.com), specialized or niche portals (e.g., cnn.com), and corporate portals (e.g., HP.com). We anticipate that the FAA entry portal will provide a single e-authentication gateway.

Just as the government strives to provide a central point for citizens to access all government information, so should individual agencies. On the Federal level, FirstGov.com has been created to facilitate the portal concept. On an agency level, the FAA currently is making progress to address its audience and create a united "One FAA" look and feel. For the FAA, the portal concept augments the "One FAA" effort by addressing a single gateway for all FAA customers to access information and services. This approach is consistent with Federal and industry practices.

Typical services that may be offered by a future FAA portal site may include a directory of Web sites, a facility to search for other sites, aviation news, weather information for pilots or citizens, e-mail, phone, map information, and a community forum. The portal will offer users the ability to create a site that is personalized for their individual interests.

Personalization is the ability of a Web site to tailor its content to a user's specific characteristics using information provided by the user or gathered by the site (for example, a particular user's page sequence pattern). Through personalization, during a pilot's search for "certification," the news or advertising banners will advertise certification programs for pilots instead of airline maintenance programs.

D.4   Content Management System

A content management system (CMS) is a system used to manage the content of a Web site. Typically, a CMS consists of two elements: the content management application (CMA) and the content delivery application (CDA).

The CMA element at FAA will allow the content manager or author, who may not know Hypertext Markup Language (HTML), to manage the creation, modification, and removal of content from a Web site without needing the expertise of a Webmaster. The CDA element will use and compile this information to update the Web site. The features of an FAA CMS system will include Web-based publishing, format management, revision control, and indexing, search, and retrieval.

The Web-based publishing feature will allow individuals to use a template, or a set of templates, approved by the FAA Web Policy Council, as well as wizards and other tools to create or modify Web content. The format management feature will allow documents, including legacy electronic documents and scanned paper documents, to be formatted into HTML or PDF for the Web site. The revision control feature will allow content to be updated to a newer version or restored to a previous version. Revision control will also track any changes made to files by individuals. An additional feature is indexing, search, and retrieval. The CMS system will index all data within FAA. Individuals can search for data using keywords, which the CMS system will retrieve. A CMS system may also provide tools for one-to-one marketing or personalization.

Two factors must be considered before FAA decides to invest in a CMS. First, FAA's size and geographic dispersion must be considered especially since FAA is decentralized and regional LOBs play critical roles. For these LOBs, the transition to CMS is more difficult. Secondly, the diversity of the electronic data forms used within FAA must be considered. If the FAA is increasingly using text documents, graphics, video, audio, and diagrams to convey information, the content will be more difficult to manage.

The FAA corporate portal concept and CMS will enable following:

- Content delivery via browsers, e-mail, PDAs, or mobile devices.
- Personalization and customization of content based on users/customer profiles.
- Multiple publishing formats such as HTML, Dynamic HTML, PDF, graphics, audio, video, or corporatewide Webcasts.
- GPEA conformance through moving to e-Forms, e-Reports, and electronic signatures and eliminating much of the paper work and delays in paper processing.
- A move towards open standards and architecture. The portal will support technologies such as Java 2 Enterprise Environment (J2EE), XML, UDDI, and SOAP, thereby laying the foundation for future Web services.
- A search engine that will retrieve customers' search requests and access information faster.

The development of good taxonomies will take into account the importance of separating elements of a group into subgroups that are mutually exclusive, unambiguous, and, taken together, include all possibilities. A portal based on taxonomies will facilitate searches.

D.5   Infrastructure

Best practice approaches to infrastructure involve:

- Security.
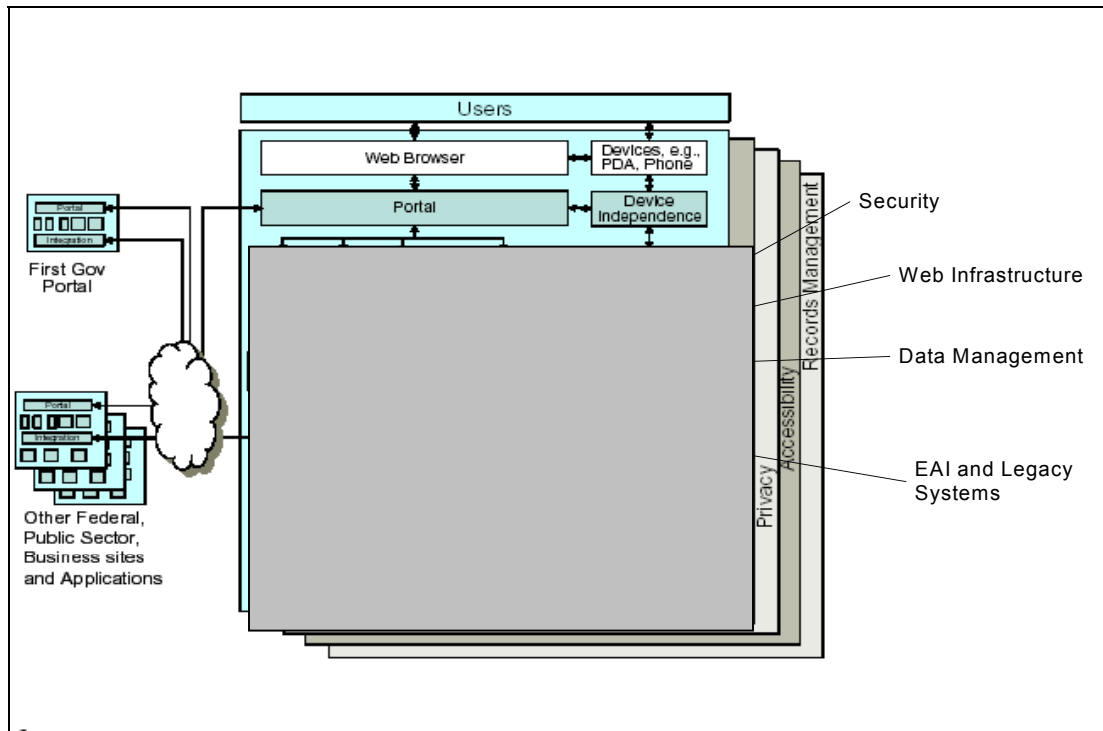- Consolidation approaches.
- Capacity planning.

Figure 20 - Highlighted Infrastructure Components

D.6   Security

A study performed by Aegis Research Corporation on FAA Web sites in March 2002 concluded that the information on the Web sites received a medium-to-high risk rating. In their findings, Aegis concluded that "The FAA does present some very sensitive information online and ... .its availability on a public site simply fails the common sense need-to-know test." Therefore, solid security measures, which include the correct content for the correct audience, are required along with infrastructure security to protect the information and services being delivered.

Regardless of the audience of Web sites, most architecture needs to be concerned with the different facets of security: authentication, authorization, encryption and auditing. In many cases, Intranet applications can take advantage of the Local Area Network (LAN)/Wide Area Network (WAN) infrastructure for their security. As an industry best practice, these features include single sign-on and role-based authentication via LDAP directory and automated PKI certificate management. In contrast, Internet architectures may use a secure network or certificate server to accomplish authentication. Common IT infrastructures for access by all constituencies include personalization, content management, search capabilities, device-agnostic features, location agnostic connectivity, and interoperability standards.

One of the key components of the Web infrastructure is security. FAA requirements clearly put an emphasis on the secured information access, delivery, and distribution. As the Web architecture matures over the three phases, some of the key components of security will be needed, and the existing components will be upgraded to meet the security requirements. The following key components will be required to support the defined Web strategy:

D.6.a   <u>Firewall</u>. A firewall is a set of related programs located at a network gateway server that protects the resources of a private network from users from other networks. (The term also implies the security policy that is used with the programs.)

D.6.b   <u>DMZ</u>.   The DMZ (demilitarized zone) is a computer host or small network inserted as a "neutral zone" between the FAA's private network and the outside public network. It will prevent outside users from getting direct access to a server that has FAA data.

A DMZ is an optional and more secure approach to a firewall and effectively acts as a proxy server as well. In a typical DMZ configuration for an organization, a separate computer (or host in network terms) receives requests from users within the private network for access to the Web sites or other companies accessible on the public network. The DMZ host then initiates sessions for these requests on the public network. However, the DMZ host is not able to initiate a session back into the private network - it can only forward packets that have already been requested.

D.6.c   <u>PKI solutions</u>. A PKI enables users of an unsecured public network, such as the Internet, to securely and privately exchange data through the use of a public and a private cryptographic key pair that is obtained and shared through a trusted authority. PKI provides for a digital certificate.

D.6.d   <u>LDAP</u>. LDAP is a software protocol for enabling anyone to locate organizations, individuals, and other resources, such as files and devices in a network, whether on the public Internet or on a corporate intranet. On Transmission Control Protocol (TCP)/Internet Protocol (IP) networks (including the Internet), the DNS is the directory system used to relate the domain name to a specific network address (a unique location on the network). LDAP will allows users to search for an individual without knowing where they are located (although additional information will help with the search).

An FAA LDAP directory will be distributed among many servers and each server will have a replicated version of the total directory that will be synchronized periodically. An LDAP server that receives a request from a user takes responsibility for the request, passing it to other LDAP servers as necessary, ensuring a single, coordinated response for the FAA Web site user.

D.6.e   <u>Single sign-on</u>. In any client/server or n-tier relationship, single sign-on is a session/user authentication process that permits a user to enter one name and password in order to access multiple applications. The single sign-on at the FAA Web site, which is requested at the initiation of the session, will authenticate the user to access all the applications to which they have been given rights on the Web server and will eliminate future authentication prompts when the user switches applications during that particular session.

In an E-Government model, single sign-on is designed to centralize the consumer information on one server - not only for the consumer's convenience, but also to offer increased security by limiting the number of times the consumer enters private information, e.g., social security numbers or other sensitive information. There is a growing trend towards the use of Web-based single sign-on that allows users to register financial information once, shop at multiple Web sites, and feel more confident about Web security.

D.7   Web server consolidation approach

Looking at the best practices of Internet environment consolidation, Giga Group states that successful data center and server consolidation projects will, on average, yield a 35-percent reduction in ongoing operations expenses, including hardware depreciation. There are extreme examples where more than 80 IT operations centers were consolidated into two centers, resulting in a reported expense reduction of 80 percent. Most of these savings resulted from human resources cost reductions, although efficiencies attained through the pooling of hardware and software resources are becoming more pronounced in environments as a result of emerging server and storage technologies in the Unix and Windows space. Another example is a global technology company which consolidated in two stages: first, from 130 data centers to four data centers over a period of several years, and then from four to one in a single year. This organization achieved a 42-person cut in operations headcount, an 8,000-square-foot reduction in used floor space, and annual savings of $10 million.

It is important to remember that there are no off-the-shelf solutions for server consolidation. Every organization will need a unique solution that matches its unique infrastructure and business model. Real-world experience shows there are four approaches to consolidation: centralization, physical consolidation, data integration, and application integration. Each of these has benefits and challenges that may be used alone or in combination to create the proper solution for FAA's business needs.

D.7.a   Centralization. Centralization involves relocating existing servers to fewer sites. Examples include moving 20 servers, scattered over three regions in one building, to a single server room, or moving 200 servers, originally installed across 20 regions, to four federated data centers. Centralization is often the initial step a company takes toward controlling costs through consolidation. It is also generally the first step taken toward rationalizing the architecture after a merger or acquisition.

D.7.b   Physical consolidation. Physical consolidation is what most people think of first when they consider server consolidation. It is the process of reducing the actual number of servers by replacing many small servers with fewer, more powerful servers or clustered systems. Physical consolidation can take place within the same architecture or across architectural boundaries. Examples include replacing several two-way UNIX servers with one 16-way UNIX server or consolidating hundreds of Intel ^{TM} processor - based servers to a mainframe server running Linux.

D.7.c   Data integration. Data integration enables the combination of data from different sources across the same or disparate data types and architectures into a central resource base. Centralizing the management control of data allows storage management tools to be applied more consistently, greatly lowering the total costs associated with managing that data. Also, in the event of a catastrophic failure, centralizing data and storage management allows the data to be restored more quickly.

D.7.d   Application integration. Application integration truly breaks the one-application/one-server paradigm. This approach involves consolidating multiple applications and data to fewer

server architectures, not only for reduced complexity but also for business process integration and automation. It allows for co-locating mixed workloads within a unified infrastructure so that applications can communicate and work together seamlessly.

D.8 The benefits of server consolidation

D.8.a <u>Lower total cost of ownership</u>. Consolidation can help the FAA reduce complexity, implement better systems management practices, and optimize capacity utilization. This can also facilitate better management of Web resources, which can result in lower costs.

D.8.b <u>Improved service levels of applications</u>. A more efficient infrastructure is generally more effective . This implies that consolidation can help the FAA enable the applications that drive the integrated enterprise to deliver increased data access, higher levels of availability, and faster response times to end users.

D.8.c <u>Increased security</u>. Consumers are demanding that their privacy information be kept private and new regulations have been developed to enforce privacy rights. As part of that, data security is becoming a competitive necessity and consolidation can help manage the security of privacy-protected information.

D.8.d <u>New business solutions</u>. Business success today depends on finding new ways to deliver customer value, which can require new applications. But many organizations are finding that they must first rationalize their server topology before they can implement critical new solutions that may enable a competitive edge.

D.8.e <u>Information as a strategic business tool</u>. The distributed computing model often created islands of applications and data. Consolidating IT/Web resources can help the FAA ensure that critical business information and processes are accessible and shared across the enterprise.

D.9 Capacity planning

The following best practices regarding capacity planning presents information that the FAA will need to consider when planning consolidation of its infrastructure. According to a planning assumption study by GIGA, capacity planning is important and needs thorough management attention.

If metrics are captured and processed statistically, capacity planning follows four simple steps:

- Evaluate the system's maximum capacity and express it in the right unit, such as number of users or transactions per second.
- Monitor and record the traffic.
- Observe trends in traffic to predict the future.
- Decide when and what to upgrade.

D.9.a <u>Evaluating maximum capacity</u>. Queuing Theory (Kleinrock, 1976) has shown that the response time of a server to a request (call it task, transaction, etc.) is a function of the system capacity. The evolution of response time to the increasing number of requests will be linear at

first until the point where it will become exponential; for a small increase in requests, there will be a huge increase in response time. This evolution is illustrated in Figure 21.
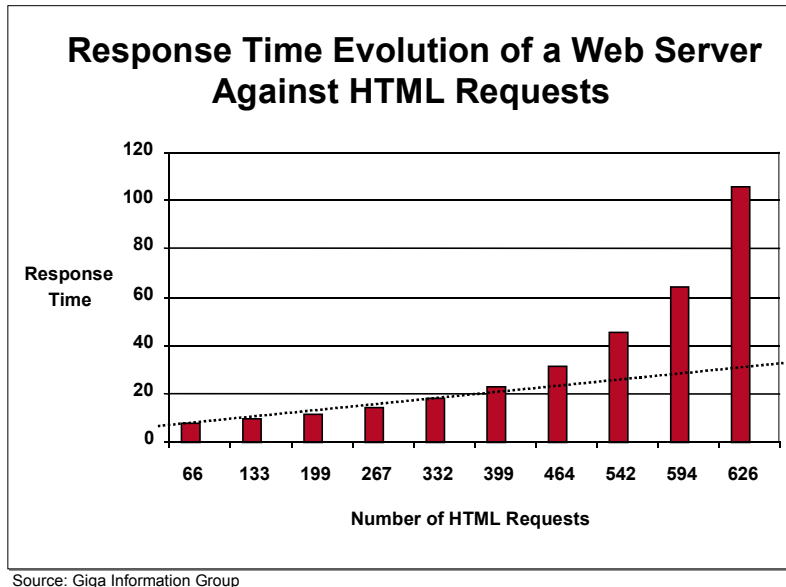
Response Time Evolution of a Web Server Against HTML Requests

Source: Giga Information Group

Figure 21 - Response Time Evolution of a Web Server

Figure 21 shows that at 464 HTML requests, the curve becomes slightly nonlinear (see dotted line). This point could be deemed the "saturation point" of the server and it is decided that its capacity is 464 HTML requests per second. Another tool available in capacity planning is the power function, which indicates the "queuing/processing" capability of the server by looking at the ratio between the number of requests and the response time (power = requests/response time). The result is usually a bell curve, which peaks at the optimum server capability (Figure 22).

A Server's Queuing/Processing Capability
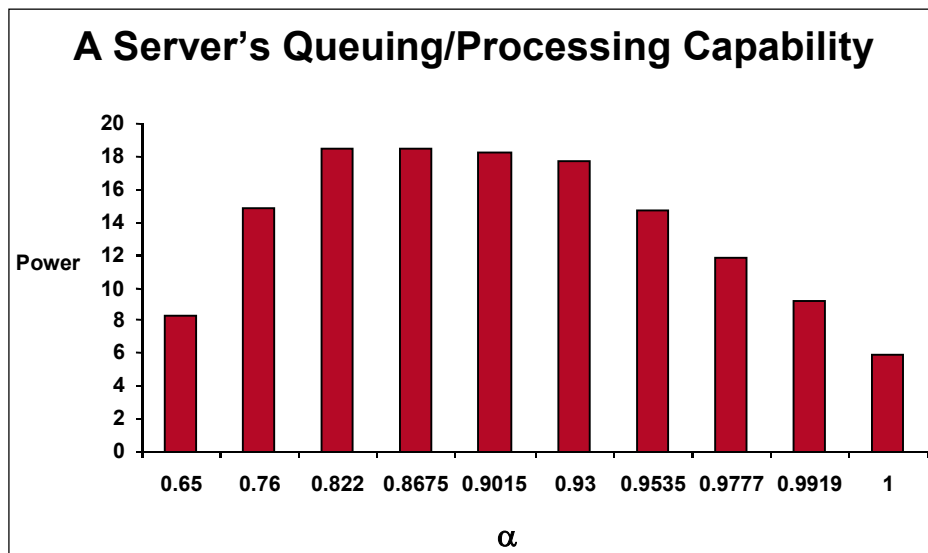
Source: Giga Information Group

Figure 22 - Server Queuing/Processing Capability

In the example shown in Figure 21, the optimum server capabilities are between 626.822 (199) and 626.93 (399), confirming the limit at which the curve becomes nonlinear. Often, only Central Processing Unit (CPU) load is available, not response time. Figure 22 shows that the system capacity varies with load, exactly like vehicle fuel consumption varies with speed and road conditions. The capacity of a gas tank, if expressed in miles, would vary also.

D.9.b <u>Trending traffic to see the future</u>. In most circumstances, customers will repeat the same steps in business processes, at the same periods of time. Using several months or years of historical data, the number of requests can be trended and future traffic can be extrapolated for the next month or several months.

D.9.c <u>Deciding when to upgrade</u>. Using the above methods for capacity planning, management should examine when maximum capacity will be reached to decide both what and when to upgrade. Because of the dissimilarity in processing speeds among system components, an analysis of system bottlenecks is necessary before making a decision to upgrade. A number of factors can cause server saturation, the most frequent being lack of memory (forcing numerous page faults with consequences on user and system processing times and disk traffic) or disk performance, caused by too slow a technology or too sloppy a volume mapping.

Appendix E – Definitions

E.1   <u>Content owners</u> - Those persons who have knowledge and responsibility for the content of a Web site/page to include not only its initial creation but also its long-term maintenance, updating, and standards compliance. Content owners are typically at a management level and ensure that the Web site's message is communicated clearly and is consistent with the FAA's mission, plans, and policies. It may be an organization, a person, or multiple persons for a given Web site/page.

E.2   <u>Government Paperwork Elimination Act (GPEA)</u> – This Act requires Federal agencies, by October 21, 2003, to allow individuals or entities that deal with the agencies the option to submit information or transact with the agency electronically, when practicable, and to maintain records electronically, when practicable. (www.whitehouse.gov/omb/fedreg/print/gpea2.html.

E.3   <u>Governance</u> - The operating model that defines an organization, in terms of roles, responsibility, accountability, and business process.

E.4   <u>Content management system (CMS)</u> – A system used to manage the content of a Web site. Typically, a CMS consists of two elements: the content management application (CMA) and the content delivery application (CDA). The CMA element allows the content manager or author, who may not know Hypertext Markup Language (HTML), to manage the creation, modification, and removal of content from a Web site without needing the expertise of a Webmaster. The CDA element uses and compiles that information to update the Web site. The features of a CMS system vary, but most include Web-based publishing, format management, revision control, and indexing, search, and retrieval. (http://searchWebservices.techtarget.com/sDefinition).

E.5   <u>Firewall</u> - A set of related programs, located at a network gateway server, protecting the resources of a private network from users from other networks. A primary firewall examines each network packet to determine whether to forward it toward its destination. Primary firewalls allow remote access into the private network or DMZ by the use of secure logon procedures and authentication certificates.

E.6   <u>Internet Access Point (IAP)</u> -Any physical or logical connection to the public Internet. An IAP includes any direct or permanent connection or any dial-up or temporary connection to the Internet.

1.   E.7   <u>eXtensible Markup Language (XML)</u> - a subset of Standard Generalized Markup Language (SGML), which has been developed by industry to support the easy and efficient transfer of information between systems, and defines how the data structures should be managed. Both XML and SGML are "meta" languages since they are used for defining markup languages. A markup language defined by using SGML or XML has a specific vocabulary (labels for elements and attributes) and a declared syntax (grammar defining the hierarchy and other features).

Appendix F – Acronyms

AIO	– Office of the Assistant Administrator for Information Services and Chief Information Officer
AIFSS	– Automated International Flight Service Station
AFSS	– Automated Flight Service Station
AFS	– Office of Flight Standard Services
AGL	– Great Lakes Region
APA	– Office of Public Affairs
ARA	– Office of Research and Acquisitions
ARTCC	– Air Route Traffic Control Center
ARC	– Office of Region and Center Operations
ATS	– Office of Air Traffic Services
AVR	– Office of Regulation and Certification
AWP	– Western Pacific Region
BP	– Best Practice
BTS	– Bureau of Transportation Statistics
CDA	– Content Delivery Application
CDIMS	– Collaborative Data Integration Management System
CIO	– Chief Information Officer
CMA	– Content Management Application
CMD	– Center for Management Development
CMS	– Content Management System
CONOP	– Concept of Operation
COPPA	– Children's On-line Privacy Protection Act
COTS	– Commercial-Off-The-Shelf
DIY	– Do It Yourself
DMZ	– Demilitarized Zone
DNS	– Domain Name System
DoD	– Department of Defense
DOT	– Department of Transportation
DHTML	– Dynamic Hypertext Markup Language
EAI	– Enterprise Application Integration
EPA	– Environmental Protection Agency
E-FOIA	– Electronic Freedom of Information Act
E-Government	– Electronic Government
FAA	– Federal Aviation Administration
FEAPMO	– Federal Enterprise Architecture Program Management Office
FOIA	– Freedom of Information Act
FSDO	– Flight Standards District Office
FTE	– Full Time Equivalent
FY	– Fiscal Year
G2B	– Government-to-Business
G2C	– Government-to-Citizen
G2E	– Government-to-Employee
G2G	– Government-to-Government

GPEA   – Government Paperwork Elimination Act
GSA   – General Services Administration
GUI   – Graphic User Interface
HTML   – Hypertext Markup Language
HTTP   – Hypertext Transfer Protocol
HQ   – Headquarters
IAP   – Internet Access Point
ICAO   – International Civil Aviation Organization
IE   – Internet Explorer
ISS   – Information Systems Security
IT   – Information Technology
J2EE   – Java 2 Enterprise Environment
K   – thousand
LAN   – Local Area Network
LDAP   – Lightweight Directory Access Protocol
LOB   – Line of Business
NAS   – National Airspace System
NASA   – National Aeronautics and Space Administration
NASDAC   – National Aviation Safety Data Analysis Center
NHTSA   – National Highway Traffic Safety Administration
NOAA   – National Oceanic and Atmospheric Administration
NOTAMS   – Notices to Airmen
NTSB   – National Transportation Safety Board
OCRWM   – Office of Civilian Radioactive Waste Management
OMB   – Office of Management and Budget
PDA   – Personal Digital Assistant
PDF   – Portable Document Format
PKI   – Public Key Infrastructure
PMA   – President's Management Agenda
RDBMS   – Relational Data Base Management System
ROI   – Return on Investment
RSPA   – Research and Special Programs Administration
SGML   – Standard Generalized Markup Language
SO   – Staff Office
SOAP   – Simple Object Access Protocol
SSL   – Secured Socket Layer
TCP/IP   – Transmission Control Protocol/Internet Protocol
TCO   – Total Cost of Ownership
TRACON   – Terminal Radar Approach Control
TSA   – Transportation Security Administration
UDDI   – Universal Description Discovery and Integration
URL   – Uniform Resource Locator
USAF   – United States Air Force
WAN   – Wide Area Network
WSDL   – Web Services Description Language
XML   – eXtensible Markup Language

Appendix G – References and URLs

G.1   External Sources:

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  o 1370.37 Internet Access Point Configuration Management.

- FAA Forms Web page http://www1.faa.gov/forms/index.html.

- Operational Security Review of Website Content – Selected FAA Websites, Dimensions International, Inc. and Aegis Research Corp., March 20, 2002.

- Usability Test Report (for FAA), June 2002.

- Web Policy Council URL: http://intranet.faa.gov/webrules/.

G.3   Selected Regulatory URLs

- Children's On-Line Privacy Protection Act (COPPA): http://www.ftc.gov/opa/1999/9910/childfinal.htm.

- W3C link: http://www.w3.org/.

- The Privacy Act as Amended (PL 93-5795 latest amendment), January 5, 1999:

http://www.gsa.gov/attachments/GSA_PUBLICATIONS/extpub/17.pdf.

- Privacy Policies on Federal Web Sites (OMB Memo 99-18), June 2, 1999
http://www.gsa.gov/attachments/GSA_PUBLICATIONS/extpub/46.pdf.

- Instructions on complying with President's Memo "Privacy and Personal Information in Federal Records" (OMB Memo 99-05), January 7, 1999:
http://www.gsa.gov/attachments/GSA_PUBLICATIONS/extpub/45.pdf.

- Guidance on Inter-Agency Sharing of Personal Data-Protecting Personal Privacy (OMB Memo 01-05), December 20, 2000: http://www.whitehouse.gov/omb/memoranda/m01-05.html.

Appendix H – FAA Home Page – November 2002